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Iron Telegraph and Telephone Poles and Electric Light Towers.

For several years attention has been directed towards the supply of telegraph poles. But a short time ago large quantities of wood poles were cut in our forests close at hand, and almost upon the ground where the larger part of the construction of telegraph lines took place. Gradually the supply grew less and less in these localities, until the telephone came into the field. The advent of this thriving industry increased the demand so much that it has become a leading problem among managers, and a difficulty not easy to meet. The rapid construction of telegraph and telephone lines all over the country, and the clamor of the press have directed public attention to the question of "unsightly poles." In some States laws have been passed, almost prohibitory in their character; in others, laws regulating the se ting and keeping these—to quote the daily papers—"public nuisances" in order. All these things create a demand, and force the companies to use larger and better poles when building a new or rebuilding an old line. Consequently the men have to go to the forests of Maine, Michigan, and Canada for their supply. The rapid devastation of these forests is also commanding attention, and grave fears have long been felt that this source of cheap poles would soon be exhausted.

Under these circumstances, it is not to be wondered at that for some time thought and money have been expended in finding a desirable substitute. As would naturally be expected, iron or steel seems to meet requirements better than any of the other metals; in fact, both have many advantages not claimed for wood.

We have the opportunity of presenting views, in our illustrations herewith, of a system of poles and also of a newly-designed electric light tower. The Milligan iron telegraph or telephone poles are not entirely new to many of our readers, but they have been greatly improved upon of late, and have some new and exceedingly good features. From tests made, these poles give much greater strength and will last three times as long as wooden poles. They are made in sections of sheet iron or steel, as the service may require, tubular and tapering. Each section is three feet long, and is telescoped together so as to be three or more pieces thick the entire length of the pole, according to the size and strength required; they can be made any length and and any diameter at top and bottom. Fig. 1 will give a general idea of these sections and the manner of telescoping them together. An interesting statement upon the strength of these poles will be found in the following letter from Messrs. Metcalf & Anderson, the well known mechanical engineers:

140 NASSAU STREET,
NEW YORK, February 11, 1884.

The Iron Telegraph Pole and Post Company,
5 Beekman Street, City:

GENTLEMEN: Agreeably to your request, we herewith submit the result of our examination of your iron telegraph pole to be constructed 50 feet long, and find the result to be as follows:

"The crushing or longitudinal strength to carry 60 wires, 700 lbs. each per mile, using 35 poles per mile, is as follows: The strength of three thicknesses of iron, allowing 38,000 lbs. per square inch, is equal to 21,584 lbs.; and increasing the thickness and strength to seven thicknesses at the bottom, there is a crushing strength of 218,500 lbs., and 1,200 lbs. will be total weight of 120 common wires. When placed 6 feet in the ground, the lateral strength at the surface of the ground we find to be 4.3 times the strength and resistance required in the most violent storms."

METCALF & ANDERSON.

Among other advantages, this method of making poles is superior to many when transportation is to be considered. They can be "nested" together traversely in a small space thereby saving much room, and their lightness makes easy handling and small freight charges. They are only about one-fifth the weight of the ordinary wood pole of equal size, and the cost of transportation is less in proportion to the weight, coming under a more favorable classification. An iron or steel telegraph pole, 20 feet long, weighs 65 lbs.; one 25 feet long weighs 85 lbs.; 30 feet long, weighs 110 lbs.

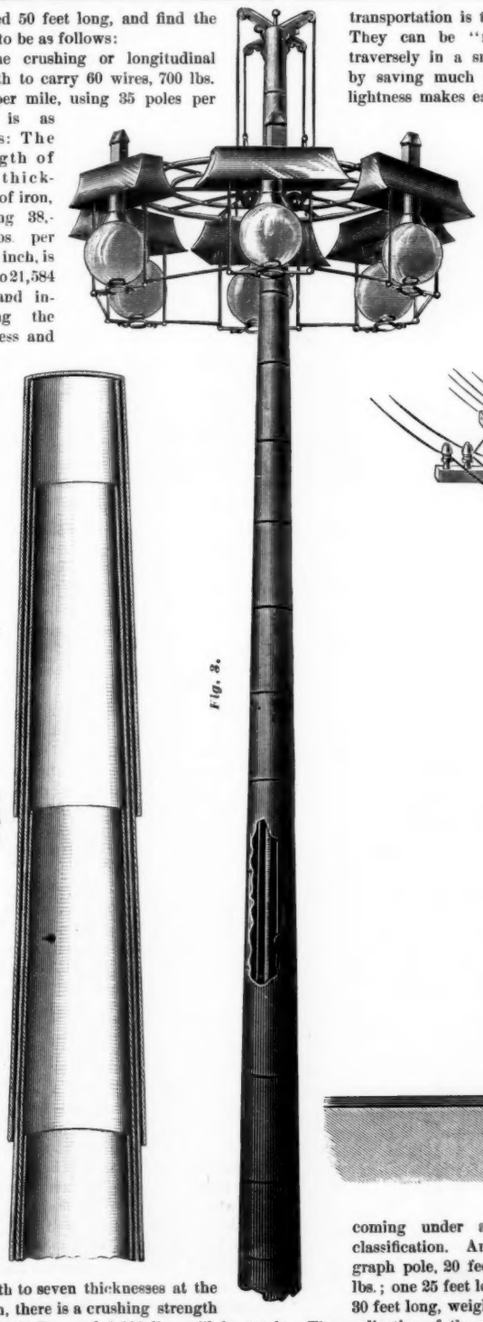


Fig. 3.

Fig. 1.

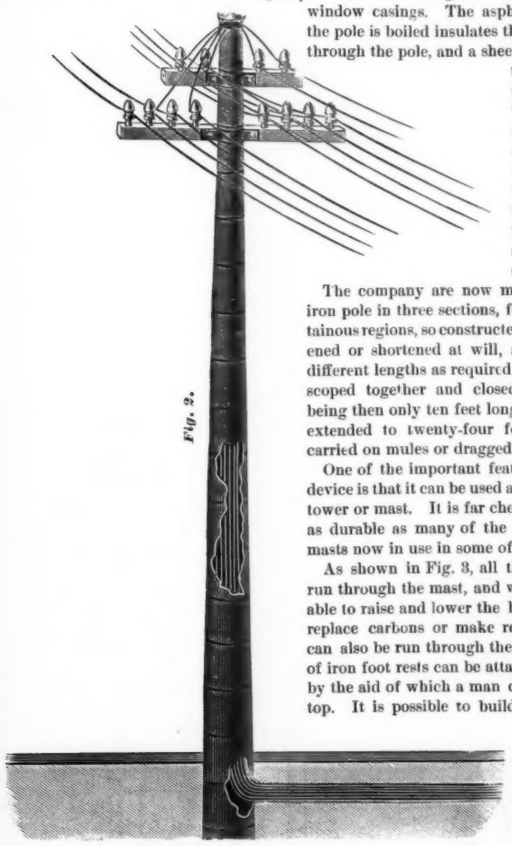


Fig. 2.

The application of the material as used in the construction of these iron poles makes them strong and practicable telegraph or telephone poles, using the metal in such manner as to obtain the greatest strength with the least quantity of iron or steel.

The use of metal poles in cities has long been favorably known. They are less liable to be destroyed by fire, and should be used wherever it is possible in telephone or electric light construction, and their durability is beyond question. Before being erected, these poles are boiled in a preparation of asphaltum, superheated, which permeates and solidifies the metal, rendering it impervious to water and rust.

In Fig. 2 we give a view of the new pole, with a section opened, showing how the wires may be run from the cross-arm insulator through the pole, thence through an iron pipe under ground into the basement, and distributed from there throughout the building thus avoiding the necessity of covering the outside of a fine building with unsightly glass insulators, wooden brackets, rubber hooks, and running the wires through the window casings. The asphaltum in which the pole is boiled insulates the wires running through the pole, and a sheet-iron cap on the top protects it from the weather. The asphaltum insulation is so complete, that when only one wire is to be run through the pole, it is not necessary to have it covered.

The company are now manufacturing an iron pole in three sections, for use in mountainous regions, so constructed as to be lengthened or shortened at will, and adjusted to different lengths as required. They are telescoped together and closed for shipping, being then only ten feet long. They can be extended to twenty-four feet, and can be carried on mules or dragged on a trail.

One of the important features of the new device is that it can be used as an electric light tower or mast. It is far cheaper and equally as durable as many of the iron towers and masts now in use in some of our cities.

As shown in Fig. 3, all the wires can be run through the mast, and where it is desirable to raise and lower the light in order to replace carbons or make repairs, the ropes can also be run through the mast, or a series of iron foot rests can be attached to the mast, by the aid of which a man can climb to the top. It is possible to build these masts to any height required, and of sufficient strength to stand the severest gales.

The company manufacturing the poles and towers is organized in New York, with offices in Temple Court, No. 5 Beekman Street.

Charles F. Brush, the electrician, with his assistants, is perfecting a new electric motor at the Brush Electric Works, to be used on street cars. The motor, which is to be stationed on the front or rear platform of the car, and there manipulated at the will of the conductor, is to be supplied with power from the Brush storage battery. The work of laying tracks for experimental purposes is almost completed.

Electric Lighters.

The convenience of the gas jet, in the gas-light system of illumination, to obtain a portable blaze when a light is required for any purpose, has rendered it desirable if not necessary that in other and superseding systems of illumination equal facilities should be afforded; particularly in the electric systems where a flame is not given out from the luminous center. Up to the present time no facilities have existed to this end, and a light for any purpose cannot now be obtained.

We illustrate to-day several forms of electric lighters designed for primary or secondary batteries, or for electric lighting systems; when used in the latter there is a system within a system made necessary in order that the electric mains or leaders may not be interfered with by their use. The principal uses to which these lighters will undoubtedly be put will be the lighting of cigars; and to this end two principles of operation have been patented from which these cuts have been designed, one being a cigar lighter pure and simple, the light being obtained from incandescent platina by nearly direct contact, and the other, through an automatic gravity switch. To facilitate its operation, a blaze is obtained at will to an alcohol or naphtha torch by contact with platina or similar refractory material of high resisting conductivity, exposed to the atmosphere.

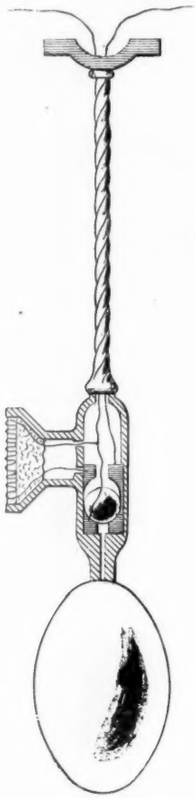


FIG. 1.

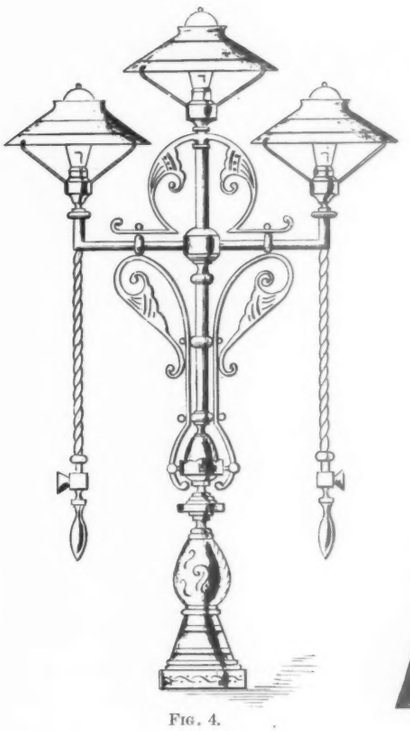


FIG. 4.

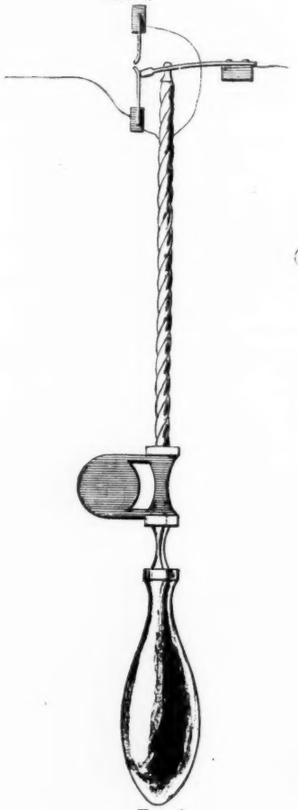


FIG. 2.

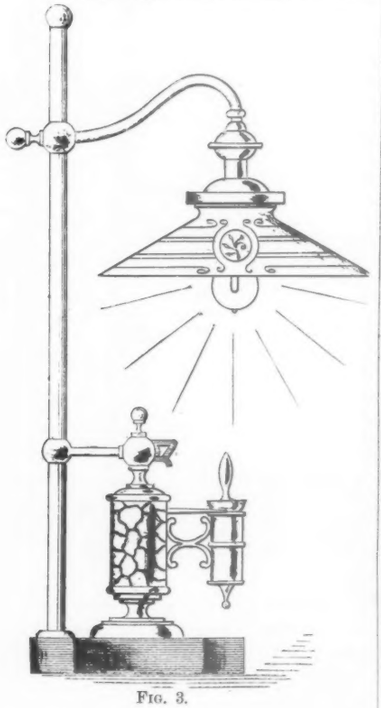


FIG. 3.

Either of these may be made not only a useful but a more or less ornamental adjunct in a lighting system, either independent of fixtures or integral with and part of fixtures being similar in this respect to the cigar lighters in the gas lighting systems; also when required for use with a battery the principle of construction can be carried out in a variety of ornamental designs. With the two forms shown, which we will designate the pendent lighter, no alcohol or volatile liquid with torch is used, the segar being lighted by direct or nearly direct contact with incandescent platina, the construction of the first (Fig. 1) is as follows: a fine platina wire is stitched through asbestos in fine stitches, this is backed with asbestos pulp and fastened into a frame of imitation stone or asbestos with other ingredients, which render it solid; this part may then be screwed, or otherwise fastened into its socket and made removable in case of breakage, and another substituted at small cost (platina foil may be substituted for the wire). The operation of this form (Fig. 1) is by the rubber bulb, which serves as a handle, the squeezing of which forces the metal sphere upward into a position to bridge the metal terminals above it; when the electric current is directed through the platina to be made incandescent, on letting go the handle the ball drops by of the combined force suction, and gravity.

In the other form illustrated (Fig. 2) the weight of the apparatus does not permit of the electric current entering the platina, and this is made possible only when the lighter is lifted to the cigar—a continuity switch being clearly shown at top of illustration. In this cut the arrangement of the platina is not clearly shown, but is wound on a cylinder made of a refractory and insulating substance which is spirally grooved to receive the wire; it may also be made adjustable as in the form last described.

Fig. 3 illustrates an adjustable students' electric lamp and lighter. Fig. 4 shows a Newell with two segar lighters of the pendent form. Fig. 5 shows the automatic gravity switch in a small vase-shaped desk lighter to be used with a battery, or like the others may be placed in the lines of an electric lighting system. Fig. 6 shows a double dip of bracket appearance operated by the gravity-switch as in the preceding; this form may with equal facility be made single and a number of them operated from the same battery, or from a lamp loop of lighting system where one exists, and when so operated would be found much cheaper than matches for places such as billiard rooms at the same time doing away with the dirt from them, and the scratching of them on tables and walls.

These lighters have been in successful use in the United States Incandescent Lighting system, and also the Edison system, and are so connected as not to interfere in any particular with the primary objects of the circuits of such a system—that of giving illumination.

In the opinion of those competent to judge these patents cover the subject of cigar lighters for incandescent systems of electric lighting; they are owned and controlled by S. D. Mott, the patentee, New York City.

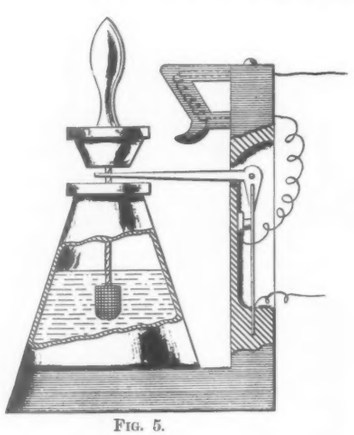


FIG. 5.

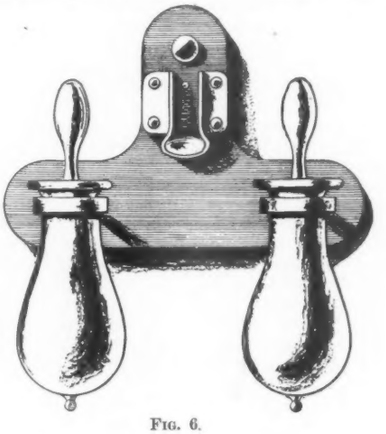


FIG. 6.

Current and Potential Indicators.

Our esteemed contemporary, *Engineering* (London), says that the new measuring instruments for electricity, which have been devised by Mr. Gisbert Kapp and Mr. R. E. Crompton, are not only intended as "meters" or measurers of the electromotive force and current, but as "indicators," which may be kept in circuit all the time the dynamo is working, or the accumulator is discharging. They are made sufficiently large to allow the engineer to read off their indications as from a steam gauge, while not too large to be portable. It is for this reason that Mr. Crompton has called them indicators.

They are designed to give the current in ampères and the difference of potential in volts at sight, without the need of multiplying the reading by a "constant;" and the liability to error in using a permanent magnet is got over by the ingenious application of an electro-magnet, kept at the saturation point by the whole or part of the current which has to be measured. Permanent magnets, as Professor Ayrton and other speakers at the recent meeting of the Society of Telegraph Engineers explained, have shown themselves apt to lose their power when used in volt and ampère meters. It would appear that one reason why the ammeters and volt meters of Professors Ayrton and Perry have not given every satisfaction in point of constancy, is that the practice of taking off and putting on the soft iron armature is prejudicial to the permanence of the magnetism in the magnet. Professor Silvanus P. Thompson has found by experiment that putting on an armature suddenly has a worse effect in reducing the magnetism than plucking it off; in fact, plucking off rather tends to increase the magnetism, whereas putting on tends to diminish it. Were both operations equal in effect, it follows that the magnet would, on the whole, retain its power; but in every-day use it would not happen that the effects balanced each other, hence it is better to dispense with an armature in such instruments; and this is what is done by Sir Wm. Thomson in his graded current and potential galvanometers. Mere shock or vibration has also the effect of driving out the magnetism of a bar of steel, and Prof. Hughes has stated that if, on magnetizing a bar, the bar be hammered, its surplus magnetism can be knocked out of it, and a residual magnetism left which is to all intents and purposes permanent, whatever rough handling the magnet may afterwards undergo. Every permanent magnet used for purposes of measurement should therefore be treated in this way, else its magnetic moment cannot be relied upon.

An electro-magnet, provided it can always be magnetized by the same strength of current, is, of course, not open to these objections; but the difficulty is to secure the same strength of current from time to time. A standard cell can be used to give it; but it is a clumsy expedient, and not very suitable for the working engineer. Mr. Crompton and Mr. Kapp have therefore adopted the plan of saturating the electro-magnet. The mass of soft iron in the core is so small in comparison to the exciting power that the smallest cur-

rent which the instrument is intended to measure is strong enough to saturate the core, and thus bring it to its full magnetic strength. Hence the directing power of the magnetic field is practically constant for all currents measured.

In the current indicator the electro-magnet *E E* is a circular electro-magnet traversed by the current. The core consists of two or three thin charcoal iron wires (No. 18 B. W. G.), and it is wound with a single layer of copper wire 1.2 millimeters in diameter. A simple magnetic needle, *n s*, is pivoted in jeweled cups between the poles, *S N*, of the electro-magnet, and a light aluminium pointer is attached to it to run over the scale. The current, after passing through the electro-magnet, *E E*, traverses the copper wire, *D D*, which takes the place of the elaborate coil in an ordinary galvanometer; that is to say, it is the deflecting coil, or coil which, by the electro-magnetic effect of the current in it, influences the needle and deflects it from its zero position. The electro-magnet, *E E*, merely serves to create a constant intensity of magnetic field, and thus produce a directive influence on the needle, thereby corresponding to the directive or controlling magnet of the galvanometer. But the passage of the current through the coil of the electro-magnet also has a deflecting influence on the coil, apart from the directive influence of the magnetism of the core; and, in order to neutralize this, Messrs. Kapp and Crompton give the plane of the coil, *D D*, a slight angle to that of the needle. This corrects what otherwise would lead to error, and leaves the deflections of the needle proportional to the current in the coil, *D D;* that is, to the current measured. This will be understood when it is remembered that the deflecting force of the coil, *D D*, can now be resolved into two rectangular components; one being in the opposite direction to the deflecting force of the electro-magnet coil; and therefore it is possible to find an angle for *D D*, such that the component in question just balances the deflecting force of the electro-magnet.

The electro-magnet, *E E*, is here made in two horseshoe halves with their like poles brought together. The core consists of two No. 18 B. W. G soft iron wires; the coil of 50 turns of 0.120 in. copper wire.

The deflecting coil is placed below the needle at *D D*. In the pivoted form the needle is mounted above and below on sapphire stones. For alternating currents the steel magnetic needle is replaced by a soft iron needle. Each indicator has a flexible clip and twin cable with terminal screws, as shown in the figure. The indicators are made of different dimensions according to the current to be measured. Thus there are instruments for measuring from 0.5 to 5, 4 to 40, 10 to 100, and 25 to 250 ampères.

The potential indicator is similar in principle to the current indicator; but the deflecting coil, *D D*, is of very fine wire, .0193 millimeters in diameter, and it is made double and placed outside the needle, this is also wound with many turns of fine wire, instead of being of low resistance, as in the current indicator. The figures show the details of the apparatus, which is made to measure from 1 to 100, 2 to 200, and 3 to 300 volts, according to size. Both the current and potential indicator can be provided with differential shunt coils in the proportion of 1 to 9, in order to multiply or reduce the readings tenfold.

One great advantage of these indicators is that they can be used in a dynamo factory, or central station, where a number of machines are at work or in course of construction. This is more than can be said for all the electric meters now extant; and Mr. Crompton has stated that it was on finding that Sir W. Thomson's instruments were of little use in his dynamo factory that he was led to devise the instruments we have described. While upon this subject, we may mention that Professors Ayrton and Perry have considerably modified their well-known ammeters and voltmeters. By the insertion of an adjustable pole-piece between the poles of the controlling magnet, they have brought the divisions of the scale to give the number of ampères and volts without multiplying by a constant. By the use of a long flat spiral spring they are able to get great sensitiveness in the readings of instruments of this class, since a slight pull on the spring gives a considerable deflection to a pointer attached at right angles to its length.

In accordance with the act of Congress under which the World's Industrial and Cotton Centennial Exposition of New Orleans will be held, the Secretary of the Treasury has issued the rules and regulations governing the duties on foreign exhibits similar to those issued for the Centennial, and also declaring the foreign department of exposition a bonded warehouse.

Hollow Magnets.

While Preece has found that there is no difference in the conducting power of lightning rods of various forms, Holtz has concluded that solid steel bars do not form so good permanent magnets as tubes, because the core acts as an armature joining the two poles. In experimenting to test his hypothesis, he magnetized rods and tubes to saturation, and found that the magnetism of the tube showed an excess of more than 50 per cent. After waiting six months, he subjected the same magnets to new tests, in order to find which retained the magnetism best. He found that the magnetism of the solid was to that of the hollow magnets, in one case as 1: 2.5, in another as 1: 2.9.—*Wied. Annalen.*

Ducretet's New Galvanometer.

M. Ducretet, the well-known French electrician, has devised a modification of the tangent galvanometer, whereby the oscillations of the needle are suppressed and currents of great intensity and high electromotive force rapidly measured. The chief novelty consists in immersing the needle completely in a transparent liquid inclosed in a compensating chamber, like that for marine compasses. It follows, from the instantaneous action of this instrument, that the current from batteries can be measured before polarization sets in; and also that all the variations of a changing current can be followed by it. The needle is small and mounted on an agate pivot. It carries an aluminium pointer moving over the graduations of the scale. The bottom of the liquid damping box carrying the needle is silvered to reflect the pointer and prevent parallax in reading off. The compass is mounted on one end of a straight graduated rule, which turns round a vertical axis and allows the instrument to be put in the meridian. A powerful directing magnet is added at will to increase the intensity of the magnetic force on the needle, as in the ordinary galvanometer. The coil is mounted on a car which slides along the rule, and can be clamped at any distance from the needle. This arrangement permits of currents being measured, varying from $\frac{1}{10}$ ampère to 400 ampères, or electromotive forces from $\frac{1}{10}$ volt to 700 volts. For measurements of intensity the current is passed through the frame of the coil. A table gives the current for the degree of deflection of the needle observed. When electromotive force is to be measured, the current is passed through a very fine German silver wire wound on the frame of the coil, and having a resistance of 5490 ohms. The intensity is then very sensibly proportional to the electromotive force. A table gives the volts for a given deflection.—*Engineering.*

Thickness of Electric Layers.

M. Lippmann has pointed out some numerical applications of Helmholtz's theory of double electric layers. He shows, at first, that the hypothesis of the double layer conducts to a parabolic relation of the second degree between the capillary tension and the difference of potential; experiment verifies this deduction. Admitting the hypothesis of the double layer, its thickness may be calculated by means of the well-known formula which gives the capacity of a thin layer as a function of its thickness. The thickness is thus found to be $\frac{1}{31000000}$ of a millimeter, which represents the distance between the mercury and the superposed water.—*Chron. Industr.*

On the Measurement of Electric Currents.*

By Lord Rayleigh, M.A., F.R.S.

Perhaps the simplest way of measuring a current of moderate intensity when once the electro-chemical equivalent of silver is known, is to determine the quantity of metal thrown down by the current in a given time in a silver voltameter. According to Kohlrausch, the electro-chemical equivalent of silver is in C.G.S. measure 1.136×10^{-2}, and according to Mascart 1.124×10^{-2}. Experiments conducted in the Cavendish Laboratory during the past year by a method of current weighing described in the British Association Report for 1882, have led to a lower number, viz., 1.119×10^{-2}. At this rate the silver deposited per ampère per *hour* is 4.028 grams, and the method of measurement founded upon this number may be used with good effect when the strength of the current ranges from $\frac{1}{10}$ ampère to perhaps 4 ampères. It requires, however, a pretty good balance and some experience in chemical manipulation.

Another method which gives good results and requires only apparatus familiar to the electrician, depends upon the use of a standard galvanic cell. The current from this cell is passed through a high resistance, such as 10,000 ohms, and a known fraction of the electromotive force is taken by touching this circuit at definite points. The current to be measured is caused to flow along a strip of sheet German silver, from which two tongues project. The difference of potential at these tongues is the product of the resistance included between them and of the current to be measured, and it is balanced by a fraction of the known electromotive force of the standard cell. With a sensitive galvanometer the balance may be adjusted to about $\frac{1}{1000}$. The German silver strip must be large enough to avoid heating. The resistance between the tongues may be $\frac{1}{10}$ ohm, and may be determined by a method similar to that of Matthiessen and Hockin (Maxwell's "Electricity," § 352). The proportions above mentioned are suitable for the measurement of such currents as 10 ampères.

Another method, available with the strong currents which are now common, depends upon Faraday's discovery of the rotation of the plane of polarization by magnetic force. Gordon found 15' * as the rotation due to the reversal of a current of four ampères circulating about 1,000 times round a column of bisulphide of carbon. With heavy glass, which is more convenient in ordinary use, the rotation is somewhat greater. With a coil of 100 windings we should obtain 15° with a current of 40 ampères; and this rotation may easily be tripled by causing the light to traverse the column three times, or, what is desirable with so strong a current, the thickness of the wire may be increased and the number of windings reduced. With the best optical arrangements the rotation can be determined to one or two minutes, but in an instrument intended for practical use such a degree of delicacy is not available. One difficulty arises from the depolarizing properties of most specimens of heavy glass. Arrangements are in progress for a re-determination of the rotation in bisulphide of carbon.

New Mode of Generating Electricity.

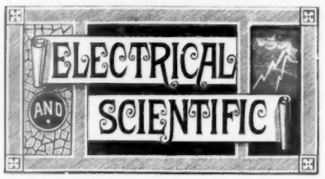
Mr. J. A. Kendall, F. C. S., of London, has discovered a voltaic generator in using occluded hydrogen instead of zinc. The cell is constructed by using a tube of platinum foil closed at one end and connected with glass tubes by which hydrogen is supplied to the platinum interior. The other element of the cell is an ordinary platinum crucible. Various substances are fused in the platinum crucible at a red heat, and by connecting both the platinum tube and crucible with a galvanometer, by means of platinum wires, a generation of electricity is obtained. Chlorides of the alkaline and earth metals in a fused state give a current; the hydrogen, after passing through the salt and walls of the crucible, is oxidized by the air. Vitreous matters, such as glass, give a better result than alkaline chlorides—even porcelain and earthenware transmitting the hydrogen at a high temperature. The effects were found to be reversible; and the quantity of electricity developed is proportional to the amount of hydrogen diffusing through the apparatus, or, in other words, to the metallic surface. It also increases with the temperature, but the electromotive force is very low. Mr. Kendall also found that the hydrogen made the vitreous substances conductive.

*From the *Proceedings* of the Cambridge Philosophical Society.

Electrical Resistance of Insulators.

In a recent issue of the *Comptes Rendus*, M. G. Foussereau described some experiments made to determine the resistance of certain insulators. We take the following abstract of the article from the *Journal of the Chemical Society* for March: "The resistances were determined in the manner previously described by measuring the time required to charge a condenser at a given difference of potential across the particular substance. The resistance of porcelain varies with the temperature, in the same manner as that of the more highly insulating varieties of glass; it is 751 at 60°, and 0.052 at 180°. (All the resistances except those of phosphorus are given in millions of megohms per cubic centimeter). The resistance of sulphur, previously fused and then allowed to cool slowly in the prismatic condition, is 7.39 at 112.1°, and 3,930 at 69°; below the latter temperature the conductivity is inappreciable. When the same sulphur is allowed to remain at the ordinary temperature for some time, so that it devitrifies, its conductivity gradually increases; in one case the resistance after one day was 1,170 at 17°; after two days, 705 at 17°. Octahedral sulphur shows no trace of conductivity at the ordinary temperature, and the conductivity only becomes appreciable at about 80°. It would appear from these facts that sulphur has a higher resistance when crystalline. When sulphur melts, its resistance diminishes to one-fortieth its original amount. If the temperature is gradually raised from 114° to 150°, the resistance gradually diminishes as the temperature rises, and it varies between these limits in the ratio of 9 to 1. When the temperature rises to 160°, the sulphur becomes darker colored and pasty, and its resistance increases.

If the liquid is again cooled to the melting point, it retains a resistance higher than the original resistance, and the difference is greater the higher the temperature to which the sulphur has been heated, the longer it has been kept at this temperature, and the more quickly it has passed 155° in the process of cooling, this being about the temperature at which the inverse change takes place. By repeatedly heating the sulphur in this way to a high temperature, its original resistance at the melting point can be increased twelvefold. When sulphur is allowed to cool in the prismatic form and is then re-melted, it shows a diminished resistance at the same temperatures. Similarly, when octahedral sulphur is repeatedly crystallized in the prismatic form, its resistance at 115° is gradually reduced to one-half. These results agree with Gernez' supposition that one variety of sulphur fully acquires the properties of another variety, only after repeated crystallizations. The resistance of carefully dried ordinary phosphorus is 84,000 megohms at 15°, and 15,600 megohms at 42°; it is of the same order of magnitude as that of liquid sulphur. The resistance of liquid phosphorus is 2.32 megohms at 25° (this is the temperature given in the original paper—apparently it should be 45°, and 0.34 megohm at 100°.



The electric light is now used in four churches in Montreal.

Bridgeport has a new joint-stock corporation—the Electrical Insulating Manufacturing Company—with a capital of $25,000. The new company will manufacture and sell electrical machines and apparatus.

A clock at Brussels has been going for 8 months and has not required to be wound up since it was first set agoing. In fact, the sun does the winding of this timepiece. A shaft exposed to the sun causes an up-draught of air which sets a fan in motion. The fan actuates mechanism which raises the weight of the clock until it reaches the top, and then puts on a brake on the fan until the weight has gone down a little, when the fan is again liberated and proceeds to act as before.

The natives of the Chiloe Islands make use of a curious natural barometer, to which, from its having been first noticed by the captain of an Italian corvette, the name "Barometre Araucano" has been given. This novel weather guide is the shell of a crab, one of the *Anomura*, probably of the genus *Lithodes*. It is peculiarly sensitive to atmospheric changes. It has a color nearly white in dry weather, but as soon as wet weather approaches small red spots are exhibited, varying in number and intensity with the amount of moisture in the atmosphere. In the rainy season it is completely red.

At the meeting of the Telegraph Engineers' Society in London last week, Mr. Massey gave an account of the electric lighting of the Putney train of the Metropolitan Railway, which was lighted during January and February by a Willard's steam engine and Siemens' dynamo, fitted in special van. The practical results were stated to be:—Cost of coal, 3s. 9d.; water, 3d.; oil and waste, 1s. 3d.; interest on plant, 3s. 3d.; in all, 11s. per 1,000 lamp-hours. The number of lamps on the train being 50, of 18-candle power each, the result would make the lighting compare with gas at 12s. for half the illuminating power.

The contract for lighting Sedalia, Mo., after some lively competition, has been awarded to Mr. F. W. Horne, the Western agent of a New York electric light company. The Sedalia Electric Light and Power Company selected a committee of three directors to look into the merits of several systems. This committee consisted of President Louis Deutsch, August Fleischmann, secretary and treasurer; and C. Kanmeyer, manager and electrician; visited St. Louis and investigated several systems, and finally came up to Chicago, where they gave Mr. Horne the contract to put his plant into operation in their city.

The London *Electrical Review* says that the war correspondent of the *Standard*, telegraphing on Sunday last, says: "There are in Suakim Harbor Russian, French, and Italian sloops of war. All these ships are furnished with the electric light and modern scientific appliances. We have the Euryalus, Carysfort, Briton, Dryad, Dragon, all large cruisers, and the Sphinx and Decoy gunboats. Not one of all these ships has the electric light apparatus, and all are deficient in the scientific appliances with which the foreign vessels are supplied. Comment is needless, but the remarks here as to the neglect and apathy of our authorities in allowing all other nations to be so far ahead of our own are general and bitter.

The Conductivity of Saline Solutions.

M. Jamin has presented a further note to the French Academy of Sciences relating to M. Bouty's observations on the conductivity of saline solutions, mention of which was recently made in these columns. The result of experiments made by M. Jamin between 2° and 44° centigrade is that (1) the electrical conductivity of a neutral salt in very extended solution increases proportionally to the increase in temperature, according to the formula, $c_1 = c_0\ (1 + kt)$. (2) The co-efficient k is the same for all neutral salts. The mean value of this co-efficient is—$k = .033543$.

Prof. Hughes on Magnetism.

In his recent paper to the Royal Society, read March 6, Prof. Hughes dealt with the discovery he has made of the presence in the interior of a magnet, of waves of opposite magnetic polarity, which balance each other when there is neutrality. In a magnet the polarity at the poles is of one name across the bar, but when the iron is neutral the poles run N S N S . . . . across the bar. He also deduces the practical result that very thin magnets have greater residual magnetism than thick ones; thick ones have more magnetic inertia and take longer to magnetise. Bundles of wires are better than solid cores because they take a higher degree of magnetization owing to surface exposure; and this is not proportionately counteracted by their higher residual magnetism. Prof. Hughes is also of opinion that all matter, and even ether, has inherent magnetic polarity and a saturation point. The curve of saturation for the atmosphere is the same in character as that of iron.—*Engineering*.

The Brush Electric Company at Detroit, Mich.

When asked in regard to the recent doings of the Brush Electric Light Company in the State of Michigan, President W. W. Leggett said that at Battle Creek, where the Brush displaced the VanDepoele system in February, 30 lights are being operated by local parties not yet formed into a company.

"There are also local Brush companies at Alpena, operating 80 lights, and at Grand Rapids, operating 200. The Brush Company at Detroit is now making estimates for lighting the Northern Asylum for the Insane, now being built at Grand Travers, 20 arc lights and 800 incandescent Brush-Swan lights, with 20 storage batteries to be used. Negotiations looking to the formation of local companies are now in progress between the State Brush Company in this city and parties in Flint, Port Huron, Kalamazoo, Jackson, Adrian, Charlotte, Traverse City, and Cheboygan.

"The Brush-Swan system of incandescent lighting from storage batteries, which we have been trying at Taylor, Woolfenden & Company's, in this city," said Mr. Leggett, "has been pronounced a perfect success by that firm, and they have decided to discard the use of gas entirely, substituting incandescent and arc lights. At Cheyenne, Wyoming Territory, houses and churches are lighted with these incandescent, storage battery lights, and the Brush Company, of this city, is prepared to furnish storage batteries and put in plants of that kind."

An Electric Indicator.

Mr. Charles L. Clarke, formerly of Portland, and for some years associated with Thomas A. Edison, has constructed electrical apparatus for indicating and recording the temperature of any distant point. It is also applicable to steam gauges, barometers, pressure gauges, and clocks. By its use the meteorological observations for the summit of a mountain can be indicated at a station located below, and in manufactories, warehouses, public buildings, and steamships, the application of the thermometer enables the temperature to be observed and, if necessary, regulated from one point. It is attracting much attention among manufacturers and scientists.

The Daniell Battery.

M. Emile Regnier, of Paris, has been carrying out a series of experiments with the Daniell battery. He tried the following solutions: 1. In the copper compartment, a saturated solution of sulphate of copper; 2. A solution of sulphate of copper, acidulated by the addition of $\frac{1}{20}$ (by volume) of monohydrated sulphuric acid. In the zinc compartment he used: 1. A solution of sulphate of zinc, 500 parts of the salt (by weight) to 1,000 of water; 2. A solution of sulphate of zinc, acidulated by $\frac{1}{20}$ of sulphuric acid; 3. A solution of sea salt, 200 parts of salt (by weight) to 1,000 of water; 4. A solution of sea salt, acidulated by $\frac{1}{20}$ of sulphuric acid; and, 5. Water, acidulated by $\frac{1}{20}$ (by volume) of sulphuric acid. With these solutions he obtained the following results:

LIQUIDS.		ELECTROMOTIVE FORCE.	
		AMALGAM. ZINC. VOLT.	ORDIN. ZINC. VOLT.
COPPER COMPARTMENT.	Solution of sulphate of copper, saturated	ZINC COMPARTMENT. Solution of sulphate of zinc	1.079	1.068
	Ditto	Ditto, acidulated	1.105	1.06
	Ditto, acidulated	Ditto	1.03	1.25
	Ditto, acidulated	Ditto, acidulated	1.066	1.03
	Ditto, saturated	Sea salt	1.145	1.14
	Ditto, acidulated	Ditto	1.115	1.09
	Ditto, acidulated	Ditto, acidulated	1.125	1.09
	Ditto, saturated	Water, acidulated with sulphuric acid	1.134	1.05
	Ditto, acidulated	Ditto	1.119	1.027

The measurements were made soon after mounting the cells. Several of M. Regnier's figures do not agree with those of Poggendorf, Joule, Regnault, and Wiedemann. This disagreement he thinks arises partly from errors in the choice of co-efficients adopted for the reduction to volts of the results obtained by these physicists.

New York is now lighted by electricity, gets its news by electricity, deals on the market by electricity, receives its quotations by electricity, has its photographs taken by electricity, talks by electricity, is treated for disease by electricity, is elevated by electricity, and shortly expects to be carried by the same subtle and powerful agency. The latest application of the fluid was in Spruce Street, where an elevator is now daily run in a six-story structure, with electricity as the motive power. The fluid is carried over house-tops for a distance of two blocks, and when applied in full force lifts over 2,000 pounds of freight with ease. Other elevators of the same character are being put in, and generating centers for the same purpose are talked of in several parts of the city. The expense is less than steam. The electric locomotive will soon supplant the steam engine on railroads. Great is electricity! And what a thundering people we shall be when we have everything run by lightning!—*The Artisan*.

The Bankers and Merchants'.

The third annual meeting of the Bankers and Merchants' Telegraph Company was held Friday, P. M. About 16,000 shares, or three-quarters of the capital stock, was represented. President A. W. Dimock made his annual report, which described the affairs of the company as being in a very progressive condition. It was stated that during the past eight months the company had extended its system from 295 miles of poles and 1,995 miles of wire to 6,697 miles of poles and 46,347 miles of wire. Additional extensions are under contract which will give the company control of 10,000 miles of poles and about 100,000 miles of wires. The Bankers and Merchants' now cover the territory from the Atlantic to the Missouri river, and from the St. Lawrence river almost to the Gulf of Mexico. The following directors were re-elected: A. W. Dimock, J. R. Hegeman, George Putnam Smith, John B. Yale, G. S. Mott, John G. Case, W. W. Maris, J. P. McKewan, and S. D. Houston. Subsequently Mr. Dimock was re-elected president, Mr. Hegeman vice-president, Mr. J. G. Case treasurer, and Mr. G. S. Mott general manager. Mr. Case has hitherto performed the duties of secretary and treasurer, but the office was divided yesterday, and Mr. J. B. Yale was elected secretary.

The Electric Railway.

Our esteemed contemporary, *Bradstreet*, says: "Though but little attention has been given as yet to the commercial development of the electric railway, this promises to be one of the most, if not the most, important of the industrial applications of electricity. With the evidence furnished by electric lighting it is hardly necessary to urge the feasibility of supplying power, by means of electricity, in the amounts needed for the operation of a railway. The modern dynamo is in fact equal to the task of furnishing electric power upon the largest scale, while the electro-motor, which is simply the dynamo reversed, is capable of doing work of the heaviest kind. On account of the small weight which can be given to it in proportion to its power, its freedom from noxious exhalations, and the facility with which it can be controlled from a distance, this motor is especially suited to railway propulsion. To utilize it for this purpose it is only necessary to establish generating stations along the line of a railway, and to provide means for conducting the current from these to the motor on the moving cars. Inventors have been busy for some time in working out systems of electric railway propulsion, and it may be said that the railway has now reached a commercial form. Doubtless much remains to be done in the elaboration of details, but the main lines have been laid. We now know the conditions upon which the economical transmission of power by means of electricity depends, and we can readily comply with them in practical construction. The dynamo requires no further improvement, as it is already the most efficient machine we possess, and an increase in this respect can be but trifling. There is considerable room for improvement in the electro-motor, but it is already sufficiently advanced for practical use, and the lines along which improvement must go have been marked out. The experimental work of Edison, Field, and others in this country, and the actual service of the lines constructed abroad by the firms of Siemens, have shown the entire feasibility of handling trains electrically with certainty and dispatch, while Profs. Ayrton and Perry have shown us how to construct an electric railway on which, at the very highest speeds, collisions are impossible — by which a moving train can automatically place between itself and a following train a blocked section on which the latter will be infallibly brought to rest. In its main elements, then, the electric railway is ready for the practical constructor. On its mechanical and electrical side there are no difficulties which cannot be overcome, but whether this is true of the commercial side many would be disposed to doubt. The lines in actual operation are yet too few, and the experience with them too meager, to enable a wholly trustworthy judgment to be pronounced; but there are a number of considerations which give reason to think that such a road can be operated in economical comparison with the present method of transportation.

"The loss resulting from the conversion of mechanical energy into that of electric currents, and the conversion of this into mechanical energy again, which constitutes the chief loss in the electric operation of a railway, need not, with the best modern appliances, exceed fifty per cent.—that is, fifty per cent. of the power applied to the pulley of the generating dynamo may be taken from the pulley of the electro-motor. The loss from resistance of the conductors and leakage need not be great, as there is no necessity of trans-

mitting the current to great distances, and high insulation can be very readily secured. Against these losses there are the gains of the system, which are neither small nor few. There is first the substitution of the stationary engine for the locomotive, with its greatly increased economy of fuel. A heavy locomotive may be dispensed with, as it is no longer necessary to secure sufficient traction. Each car may become self-propelling, as the whole set of motors on a train can be controlled from a cab at the head, with the same ease with which continuous brakes are now operated. Such a distribution of the weight allows of a lighter equipment throughout—roadbed, rails, bridges, etc.—and would diminish greatly the wear and tear. Lighter trains can be more quickly stopped, and accidents, therefore, more readily avoided than is possible under the present system of transportation. The absence of sparks and cinders, aside from the increased comfort of travel, has an economic value, as the damage done by the locomotive to property along a line of railway is no inconsiderable item.

"The advantages which would accrue to the traveling public from the adoption of electric propulsion are very numerous, but there is one in particular which has been recently pointed out by Lieutenant Fiske, which would do much to commend the system to travelers. This is the change that becomes possible, on account of the way in which the motive power is applied, in the character of the passenger service. With the steam locomotive the train system is the only possible one, but with electric propulsion this is no longer necessary. As each car may be provided with its own motor, it would cost no more to move it by itself than when it forms one of a number, and the electric service can, therefore, approximate to that of present rapid transit in cities, in which short trains following each other in quick succession take the place of long ones at greater intervals of time. How valuable such a feature as this would be any one who has had to wait for a train or who has missed one by a few minutes can readily appreciate.

"The electric railway combines all the elements requisite for the most complete railway service. It is as capable of doing the work of a great trunk line as that of the smallest feeder, and if it can do it as economically—which seems probable—its future is one of the greatest magnitude. It is not necessary, however, to put its capabilities to the test at once upon the steam railroads of a country. There is a wide field for it in city and suburban transportation, a field in which all the questions that inevitably arise in practice can be settled, and in which the system can be wholly freed from an experimental character. In this field its right to possession can hardly be successfully disputed. On surface roads it is quite capable of competing with horse traction. In large cities, however, the demand for rapid transit must increasingly require the adoption of those forms of transportation which will in reality be speedy. Such a service is not practicable on a surface road, so that this requires the elevation of the tracks above the street or their depression below it. Under these circumstances the electric railway will have as a competitor some form of mechanical motive power. The steam locomotive, though used to a limited extent, as on the elevated roads of this city, is clearly out of place here. The compressed air motor, though long before the public, has never succeeded in getting into use, and need not be reckoned on. Probably the only competitor with which electricity would have to contend is the cable system of propulsion, which has been in successful operation for the past few years in San Francisco and Chicago. This competitor is not one, however, to be much feared by the electric railway. Between a system very limited in its application and essentially crude, from the engineer's point of view, and one which combines all the elements of a perfect system of transportation, and which is capable of indefinite expansion to meet the largest and most varied service, there can hardly be said to be any competition.

Doubtless much has been claimed for electricity which was not warranted, but it possesses, nevertheless, very large powers for industrial good. The period of experimental floundering and of financial craze have both passed, and we are now possessed of both experimental and financial standards by which new results can be gauged. Tested by these, electricity will be found to have real and substantial merits. The perfection of the method of mechanical development of electric currents has conferred upon civilization a new power—a power which is capable of profoundly modifying industrial development. The past fifty years has been, above all other things, devoted to the development of mechanical engineering. It will not be wide of the mark to say that the distinguishing feature of the industrial development of the next fifty years will be the extent and variety of the application of electricity, and among them the electric railway will not be the smallest or the least important.

Electrical Devices Classified.

The general Committee on Underground Electrical Communication met in the Borcel Building, Friday, and discussed devices and inventions for ridding the streets of poles and wires. The sub-committees on Electrical and Mechanical Devices, Law and Franchises, and Business Organization embodied their views in a detailed report, giving classified and technically scientific information about all the systems ever invented or devised in this or any other country. The merits and demerits of thirteen different systems were minutely considered. The document was a condensation of a year's correspondence, covering thousands of pages, arranged by William C. Behrens, an electrical expert. The report was sent to the printer, and a copy will be forwarded to each member of the committee for study before another meeting.

"While the difficulties in our path are almost infinite," said a member of the committee yesterday, "I think I am justified in believing that definite results will be obtained. The compulsory bill, which has just passed the State Senate, came up incidentally in the discussion, and before the House is ready to act upon it we hope to be able to offer some suggestions which may materially aid in accomplishing the desired result. The amount of scientific information on this subject, contained in the report submitted to us to-day, has never before been arranged so that it might be thoughtfully examined. When the members of the committee have had an opportunity to digest it, the work must, I think, be productive of good results."

We print herewith a call recently issued for the purpose of organizing a National Electrical Society:

"The rapidly-growing art of producing and utilizing electricity has no assistance from any American national scientific society. There is no legitimate excuse for this implied absence of scientific interest, except it be the short-sighted plea that every one is too busy to give time to scientific, practical and social intercourse, which, in other professions, have been found so conducive to advancement.

"The American Societies of Civil, Mechanical and Mining Engineers, which have been so prosperous and of such great advantages to their members, are good examples.

"An International Electrical Exhibition is to be held in Philadelphia next autumn, to which many of the famous foreign electrical savants, engineers and manufacturers will be visitors; and it would be a lasting disgrace to American electricians if no American national electrical society was in existence to receive them with the honors due from their co-laborers of the United States.

"It is proposed to organize the American Institute of Electrical Engineers, somewhat after the model of the American Civil, Mechanical and Mining Engineers' Societies or Institutes. These societies hold yearly three or four meetings, lasting three or four days each time, at various suitable places throughout the country, at which meetings the members assemble, read and discuss papers and matters relating to their trades and professions, and at the same time enjoy pleasant, personal, social intercourse, all of which is conducive to improvement and advancement in ideas, theories, practice, business and good-fellowship. The success of these societies, as well as of the various foreign electrical societies, makes it seem probable that those persons who are interested in our electrical, scientific, educational, manufacturing, telegraphic, telephonic and like concerns, as well as the users of electrical appliances generally, will find it to their advantage, personally and collectively, to establish, support, work for, and generally aid our proposed society.

"It is proposed to make electrical engineers, electricians, instructors in electricity in schools and colleges, inventors and manufacturers of electrical apparatus, officers of telegraph, telephone, electric light, burglar alarm, district messenger, electric time, and of all companies based upon electrical inventions, as well as all who are inclined to support the organization for the common interest, eligible to membership.

"It is proposed to make the yearly dues about ten dollars, and to print in book form the papers, discussions and transactions at the meetings for distribution among the members without further expense. As with other societies, these will be worth more than the annual dues. Affiliations with sister societies, a museum, library, original research, protection from unfavorable legislation, settlements of disputed electrical questions, exchanges of volumes of transactions with foreign and other electrical and scientific societies, a journal of abstracts of papers read before other societies, or published in other journals, etc., etc., are all proposed.

"The subscribers hereto hereby extend an invitation to all those persons who are eligible to membership to meet them in New York City at a place to be announced here after, on Tuesday, the 13th day of May, 1884, for the purpose of organizing the proposed national electrical society upon substantially the basis herein set forth.

"Communications upon the subject should be addressed to N. S. Keith, *Electrical Engineer*, 237 Broadway, New York City.

Norvin Green, president Western Union Telegraph Company.
A. W. Dimock, president Bankers and Merchants' Telegraph Company.
Thomas A. Edison, inventor.
George B Prescott, electrician.
Frank L. Pope, solicitor of patents.
George A. Hamilton, electrician Western Union Telegraph Company.
Gerritt Smith, circuit electrician Western Union Telegraph Company.
Rowland R Hazard, president of the Gramme Electric Company.
Charles L Buckingham, counsel Western Union Telegraph Company.
Chas. S. H. Small, assistant superintendent Gold and Stock Telegraph Company.
Stephen D. Field, electrician Commercial Telegraph Company.
S. D. Schuyler, president Schuyler Electric Light Company.
L. E. Curtis, secretary United States Electric Lighting Company.
Edward Weston, electrician United States Electric Lighting Company.
C. O. Mailloux, electrical engineer.
E. A. Leslie, superintendent Baltimore and Ohio Telegraph Company.
Charles D. Haskins, electrical engineer Western Electric Company.
J. A. Seely, electrician Metropolitan Telegraph and Telephone Company.
J. H. Bunnell, electrical manufacturer.
George B. Scott, superintendent Gold and Stock Telegraph Company
S. B. Eaton, president Edison Electric Light Company.
W. H. McGrath, superintendent Brush Electrical Illuminating Company.
H. Seymour Geary, vice-president Fuller Electrical Company.
A. B Chandler, president Fuller Electrical Company.
William Hochhausen, president Excelsior Electrical Company.
George D. Allen, secretary Excelsior Electrical Company.
A. A. Hayes, president Brush-Swan Electric Company, Washington.
Augustus C. Graham, manager *Electrician and Electrical Engineer*.
George M. Hopkins, electrician.
L. G. Tillotson, manufacturer.
G. V. B. Frost, superintendent American District Telegraph Company.
R. D. Buchanan, general manager Overland Telegraph Company.
P. B. Delany, synchronous Multiplex Telegraph.
Edward A. Calahan, secretary Standard Multiplex Telegraph Company.
William C. Behrens, secretary Com. Underground Wires.
T. H. Delano, publisher *Electrical Review*.
William A. Childs, president Law Telephone Company.
Frank Shaw, engineer Law Telephone Company.
Charles J. Van Depoele, electrician, Van Depoele Electric Light Company, Chicago.
C. E. Chinnock, Edison Electric Illuminating Company.
H. L. Bailey, electrician The Time Telegraph Company.
Theodore Mace, agent Electrical Supply Company.
W. H. Eckert, general superintendent Metropolitan Telegraph and Telephone Company.
Robert Brown, superintendent Metropolitan Telegraph and Telephone Company.
E. N. Dickerson, Jr., electrician and counsel in patent causes.
D. Van Nostrand, publisher of scientific books.
W. J. Johnston, publisher of *The Electrical World*.
F. W. Jones, electrician Bankers and Merchants' Telegraph Company.
James W. McDonough, electrician United States Telephone Company.
Thomas R. Taltavall, Associated Press.
N. S. Keith, electrical engineer.
Bradley A. Fiske, author "Fiske's Electricity."
George W. Stockly, vice-president and manager Brush Electric Company.
H. C. Roome, general manager, Holmes Electric Protective Company.
E. Holmes, president Holmes Electric Protective Company.
Thomas D. Lockwood, electrician American Bell Telephone Company.
Professor Elihu Thomson, electrician Thomson-Houston Electrical Company.
Robert Hewitt, Jr., treasurer Telemeter Company.
Charles E. Buell, electrician, New Haven.
George F. Bulin, general superintendent Automatic Fire Alarm and Ex. Company.
Professor P. H. Vander Weyde, president New York Electrical Society.
Professor A. K. Eaton, electrician, Brooklyn.

Decision Under the Patent Laws.

The Commissioner of Patents has made the following decisions under the patent laws: No matter whether an inventor is a pioneer in his line or not, he cannot make a valid claim, the scope of which is so extensive as to include means substantially different from those described, even though the same result may be produced by such different means. An inventor may, however, employ language sufficiently comprehensible to include colorable variation of his invention and mechanical equivalents thereof, and if the state of the art will justify it, modification differing in form, but embodying the same principles. An abandonment of an invention is not to be presumed from the fact that it is shown and described, though not technically claimed as a patent. If there is coupled with such description and disclaimers, notice and reservation and declaration of the purpose to claim such invention in subsequent application, it is not intended to sanction the practice of incorporation, in patents, the declarations of reservations of particular inventions not claimed therein. Such practice ought only to be permitted in exceptional cases.

Politeness by Telephone.

A Mexican correspondent says: "There is a considerable variety of tongues among the messages going over the telephone wires in Mexico; many persons who cannot speak each other's language wishing frequently to be put in communication, so the offices usually have an attendant interpreter. The peremptory American method of making telephone calls—'Hello!' 'Hello?' 'Give me 1,299!' etc.—would never do in the polished Castilian tongue. Courtesy of intercourse must be preserved even between invisible communicants, and the unseeming vexatiousness and petulance which the telephone seems to provoke in Saxon moods is never allowed to obtain utterance here. The regular response from the central station to a telephone call is, 'Man de usted!' which is equivalent to 'At your command!' Then preliminaries are gone through something as follows: 'Good morning, senorita; how do you do?' 'Very well, I thank you; what service may I render you?' 'Will you kindly do me the favor of enabling me to speak with Don So-and-So, No. 777?' 'With much pleasure!' etc., etc., and when the connection is made the usual polite introductions are gone through before proceeding to the business in hand."

Telephonic News

Under the energetic management of Mr. W. A. Beach, Toledo, Ohio, now scores 315 new subscribers, added since he took charge of that exchange, one year ago, and 200 at Sandusky.

Our correspondent says—The Cumberland Telephone Co. has, during the six months last past, made very rapid strides, and its last report shows an increase in subscribers of about 20 per cent. more than they had in September last. The model exchange at Nashville now shows a list of 960 subscribers, and Memphis 710; and the following new exchanges make an equally-good showing: Gallatin has 59 subscribers, Franklin 27, and Union City 61. Captain Marrs, Mr. Babcock, and Mr. Baker are entitled to great credit for the able manner they have managed the affairs of this company during the past year, and we wish them the continued success they deserve.

To a proper understanding of the percentage of the earnings of the American Bell Telephone Company, for the past year, it ought to be understood that the capital stock at the beginning of the year was $7,350,000, and at the close of the year $9,602,100. The average stock upon which the earnings were made, for the past fiscal year, was $8,451,000. Net earnings of $1,475,431 upon an average capital of $8,451,000 in earnings of 17 44-100 per cent.

At New Orleans, La., our correspondent says that the Great Southern Telephone Co. have just moved their central office to their new building corner Carondelet and Poydras streets. The transfer was made in six days. New wires have been run upon poles (magnificent cedars, 50 to 75 feet poles) to every subscriber. They are using the Western Multiple Board; fitted up for 1,500, and capacity for 2,500 subscribers.

In making the transfer everything moved splendidly; very little line trouble and almost none with the operators. They are now fixing up odds and ends, and taking down the old house-top wires.

A new electric light company has been chartered (the Louisiana) to introduce and operate the Levert-Mueller system.

On account of a large crevasse at Davis plantation, about twenty miles above here, on the West bank, the telegraph and telephone lines are down, and both the Morgan and Texas & Pacific railroads are compelled to steamboat their traffic from here to a point above, their tracks being under water. The river is higher than ever known before.

The Dallas (Texas) Telephone Exchange is the center of a very extensive telephone system, having within the limits of this, the Dallas exchange, 310 subscribers and over 200 miles of line wire. There is also 615 miles of country lines branching out from here and connecting with the following towns and cities, and with which we can now speak and transact business, viz:

Fort Worth, Weatherford, Whitts, Jacksboro, Graham, Post Oak, Henrietta, Denton, Waketon, Grapevine, Eagleford, Alverado, Midlothian, Cleburne, Hillsboro, Waco, Milford, Garrett, Ennis, Italy, Waxahachie, Red Oak, Terrell, Forney, Kaufman, Greenville, Commerce, Farmersville, Bells, Savoy, McKinney, Sherman, Van Alstine, Denison, Lancaster, Mill Sap, Mineral Wells, and Palo Pinto.

There is also a line in course of construction from Sherman to Gainesville, which will connect us with that point, and also with Whitesboro, Burlington, Montague and St. Jo. It is contemplated at no distant day to build an additional line from Hillsboro connecting with Itaska and Grand Vein *via* Alvarado, to this point and to Fort Worth. The exchange at this place, under the management of Mr. C. A. Reed, is giving much better satisfaction than heretofore, and the service is constantly improving. New telephones are being put in daily. New and larger poles are being erected, which gives the lines a much better appearance, and taken altogether, the exchange is in a prosperous condition. Mr. D. M. Clower, the efficient superintendant of this division, has his headquarters at this place.

Editor Electrical Review:

DEAR SIR:—I notice through the columns of your paper that Mr. W. F. Black, superintendent of the Worcester Division of the New England Telegraph and Telephone Company, is about to resign his present position to accept a much more lucrative and responsible one.

He goes to Minneapolis, Minn., as general cashier for the Northwestern Division of the Erie Telephone and Telegraph Company. I think the managers of the Northwestern Division are indeed fortunate in securing such a valuable man as Mr. Black. I have been personally acquainted with him since he first entered the telephone field some three years ago. His rapid advancement in the ranks of telephoning shows his superior capabilities, and has proven that he is a thorough business man, fine accountant and an able electrician.

I can truthfully say that he has no superior in the telephone field. He enters his new field of labor with the best wishes of all his many friends.

I congratulate Mr. Black in having such a man as C. H. Denman, Esq., to co-operate with him in the management of his responsible duties. E.

Success of the Telephone in Frederick.

The ringing of the telephone bells now greets one in every principal business place in the city, and are in use in many private residences. The different parts of the city are connected with a web-work of wires, and where these wires enter the exchange building it reminds one of the hundreds of tiny threads in a weaver's loom. To show those who are unacquainted with the work that has been going on during the past month of the universal use of the great invention in Frederick, we will say that twenty new ones have so far been added, and a number more will be put in as soon as the instruments arrive. Altogether about $3,000 worth of contracts throughout the county, principally through the northern portion, await to be filled, and as soon as the weather permits the work of planting the poles will begin. Superintendent Miller, and his assistant, Mr. G. Hoskins Morgan, are both hardworking gentlemen, and it is through their energy and push that the company has attained its present proportions in this locality. The work is under their personal supervision, and it is laughable to see the slight form of Mr. Miller tugging at a wire here, or directing the erection of a pole there; introducing a new connection to its hundreds of acquaintances on the switch-board (welcome visitor), and in a thousand-and-one ways hastening the work along. Mr. Miller is a thorough and practical electrician, and is well up to his business. He tells us that through the aid of his efficient manager, Mr. Morgan, he will by July have more subscribers than any two exchanges in the State, Baltimore excepted. Success to all around. MUNSON.

The *Mexican Financier*, published at the City of Mexico, in its edition of the 8th of March, has the following item of interest to some of our readers:

THE TELEPHONE MANAGEMENT.

"To the Editors of the Mexican Financier:

"The undersigned has the honor of informing his friends and the public generally that he has resigned his position as general manager of the Mexican Telephone Company, to take effect April 1, 1884, and meanwhile will take no active part in the management. He begs that his friends and the public will continue to his successor and to the company the friendly feeling and assistance so often shown to himself.

"G. L. WILEY,

Mexican Telephone Company.

"Mexico, March 5, 1884."

It further says that "it will be seen by a communication in this issue that an important change has taken place in the management of the Mexican Telephone Company. The resignation of Mr. Wiley as general manager will be received with wide regret, for not only is he highly esteemed on account of his personal character and genial qualities, but as a thoroughly trained electrician he has placed the service upon its present high plane of efficiency. Mr. M. L. Guiraud, his successor, is qualified for the post by a long experience with the company, and his extensive acquaintance and connections in the capital will assure many friends for the institution. Mr. D. J. Hobart, from Guadalajara, will act as superintendent under his management. Mr. Wiley resigns to take advantage of other lucrative inducements here. The Telephone Company will send to Boston on April 1 the first instalment of net earnings on its business."

On Saturday last the Edison Gower-Bell Telephone Company, of Lisbon, Portugal, had the honor of transmitting the opera "Lauriana" by telephone to the Ajuda Palace of the King of Portugal. As this was the first performance in Portugal of this opera, which is composed by a Portuguese, the king and the court were much disturbed at being unable to attend, owing to the recent decease of the late Princess of Saxony. However, the difficulty was overcome by the opera being transmitted by telephone. The arrangements at the Opera House consisted of six microphone transmitters, connected in multiple arc, two of them being Blake transmitters, and the remainder Gower-Bell. Four were placed on the bases of the columns in front of the curtain, about six feet above the stage, and two, on either side of and behind the prompter's box, were one foot above the stage. All the instruments were placed on lead supported by soft India rubber pedestals, in order to lessen as much as possible the effects of extraneous vibrations. A metallic circuit of ten miles of wire was employed, and any transmitter could be cut out without disturbing the remainder. Each transmitter had three sets of two Leclanché batteries each, which were switched on in succession every twenty minutes, on account of the rapid polarization of these batteries when on short circuit. Whenever the bass and more metallic instruments of the orchestra were brought into full play, two of the Gower-Bell transmitters and occasionally a third were cut out, to avoid the jarring effect which would otherwise have been produced. At the receiving end, in the palace, ten Gower-Bell receivers were placed. The telephones were themselves hidden from view by flowers, from which emerged the two ear tubes of each receiver. The whole of the royal family and a distinguished party heard the opera by these means. The king afterwards expressed his complete satisfaction, the transmission being perfect and even the words of the singers being understood The arrangements were under the direction of Mr. Alan Danvers, the company's representative and engineer in Lisbon.—*Ex.*

The Static Telephone in Research.

Our contemporary, *Engineering*, says that the magneto-telephone of Graham Bell has proved of great value in research, and Professor S. P. Thompson has recently applied the static telephone of Dolbear to the same purpose with considerable success. Professor Thompson has used it for investigating the action of "influence" machines, such as those of Holtz, Toepler and Wimshurst (see *Engineering*, Vol. XXXIV., page 3). When the end of the wire from the insulated plate of a Dolbear receiver is held near the revolving discs of these machines, a sound is heard in the telephone by induction. As might have been expected, Professor Thompson finds the discharge from the Holtz class apparently more continuous than that from the Wimshurst or carrier class. The Dolbear instrument has also been used by Professor Thompson to take the place of the galvanometer in a Wheatstone balance of condensers; if we may use the term, when condensers are compared instead of resistances. The condensers, which correspond to the divided coil of the Wheatstone balance, have been ingeniously combined by Professor Thompson in the following manner: Two glass tubes are coated with tinfoil and a brass tube slides into both the glass tubes, and forms the common insulated armature of both condensers; while the tinfoils form the earth armatures of the two condensers thus combined. The arrangement allows of the ratio of the capacities of these two condensers being easily adjusted by shifting the brass tube between them. When the "balance" of condensers is made up in a similar way to Professor G. C. Foster's method of joining up the Wheatstone balance, the results are more accurate than with the ordinary method. This disposition was suggested to Professor Thompson by Mr. Starling, his assistant. Other applications of the Dolbear telephone will suggest themselves to experimenters, now that Professor Thompson has shown its value; and it has the advantage of being a very handy instrument. For example, as Professor Thompson showed, it can be employed to map out equipotential surfaces round charged bodies; but in this, as in the other cases mentioned, the fluctuating current from an induction coil must be used instead of a continuous charge. Thus, when the two terminal wires of the telephone are on the same equipotential surface, no sound is heard in the telephone; but a sound is heard if they are not.

The National Telephone Company.

NEW TRUNK SYSTEM IN GLASGOW.

The London *Electrical Review* says that in Glasgow the National Telephone Company has adopted, so far as possible, the policy of opening subsidiary exchanges wherever a sufficient number of subscribers could be obtained, in order not only to give all firms the benefit of the system at the ordinary rate, although they were outside the usual radius from the center of the city, but also to keep down, as much as possible, the mass of wires in the center of the town.

So long as there are only three or four of these exchanges, no difficulty was found in connecting them together by trunk wires, but when they increased in number—there are now seven in Glasgow—and as also the number of subscribers increased, it becomes a matter for consideration how satisfactory and quick trunk service was to be given between these exchanges.

The system which has now been adopted and put in operation is, we believe, already in use, in some form, in Paris, but not in any town in this country, and a short account of it may be interesting.

An exchange has been opened quite distinct from any of the other exchanges, and which is called the "Trunk Exchange;" it is connected with all the other exchanges by numbers of wires, varying according to the number of the subscribers in each exchange, the total number of Trunk wires now in use in Glasgow being 90. In the Trunk Exchange is an ordinary card switchboard, but with no indicators, and specially designed for quick service. From each exchange is a speaking wire to the "Trunk Exchange," which is in connection with a key on the operator's table. The mode of getting connected is as follows: The operator wishing another exchange presses the key which cuts her instrument into the speaking wire, and so puts the operator instantaneously in connection with the "Trunk Exchange." She then gives the name of her own exchange, and the name of the exchange wanted. The trunk operator at once, and by one movement, connects the wires which makes a direct wire between the exchanges wanting each other. As the trunk operator has simply the wires to connect, and nothing else to

do, the connection is made very quickly. It has been carefully timed, and it is found that communication is established in four seconds. It is found that the one operator can handle the 90 trunk wires with ease.

If the speaking wire was to go out of order, it will be readily seen that the system would be seriously disorganized; but provision has been made against this by arranging that in the case of such a thing happening one of the other trunk wires can be substituted, and by the operators themselves.

The system is found to work admirably, and has tended to improve the service, there being now no delay in getting through from one exchange to another.

The work has been in progress for the last three months, but the final change was made about a fortnight since.

The whole work of designing and fitting up the apparatus and making the necessary alterations, and also in adapting the system to the special requirements of the system, has been carried out under the direction of Mr. D. Sinclair, the engineer and electrician of the company's Glasgow district.

The Cumberland Telephone Company.

INCREASE OF THE QUARTERLY DIVIDENDS—SATISFACTORY PROGRESS HERE AND ELSEWHERE.

Our Nashville correspondent says: The quarterly meeting of the directors of the Cumberland Telephone Company was held in Nashville on Friday last. There were present:

E. S. Babcock, Jr., of Evansville, Ind., President; Paul J. Marrs, Superintendent; E. T. Baker, Secretary, Treasurer and Manager—and the following other directors: James Compton, G. R. Knox and Isaac T. Rhea.

The company's affairs were reported to be in an extremely satisfactory condition. The increase of its business in Nashville alone may be judged from the following facts:

During March thirty instruments were put in, and yesterday there were orders on the books for twenty-seven more. Although a switch-board for 900 instruments was set up only the middle of last January, it is already found necessary to increase the facilities still further, and the directors decided yesterday to make the capacity of the exchange 2,100 instruments. This is indeed a remarkable development in the use of a comparatively new invention.

A most gratifying increase is also reported in regard to Memphis and other points in the State. Memphis started in October with an improved service embracing 450 instruments. She now has 675, and flatters herself that she will get away with Nashville in the use of the telephone.

The company's success is chiefly due to its efficient service—the courtesy of its employes, and the promptness with which business is dispatched.

The new line being constructed from Shelbyville to Nashville is now within fifteen miles of this city, and will be completed within a few days.

Dickson, on the Northwestern railroad, was connected with Nashville by telephone yesterday for the first time.

The directors state that they are ready to open telephone communication with any part of the surrounding country where the people subscribe sufficient stock to construct the line.

Woodbury and Manchester seem to be unfortunate in their efforts to secure telephone communication with Nashville. The citizens of the former place have taken the amount of stock required for the construction of a line to Murfreesboro, and the contracts for the poles has even been let, but the directors of the Murfreesboro & Woodbury Turnpike Company refuse to grant the right of way unless the seven directors be permitted the free use of all the telephone company's lines. The company's officers say that, of course, they cannot agree to such terms. McMinnville had also subscribed three-quarters of the stock necessary to put up a line from there to Woodbury. It may be supposed there is no little grumbling in the towns named on account of the complication.

When the lines were put up in Franklin, only the other day, the most sanguine friends of the enterprise did not believe that more than ten instruments would be needed. There are already twenty-six in use.

In Gallatin every telephone is a fire-alarm, being connected with the fire department headquarters.

At the meeting yesterday the Cumberland Telephone directors increased the quarterly dividend to 2 per cent., which will be paid April 15.

President E. S. Babcock, Jr., talks of removing from Evansville and becoming a resident of Nashville.

R. S. Boyd, special agent of the American Bell Telephone Company, was in the city yesterday, and attended the meeting of the directors of the Cumberland Telephone Company.

Nashville, April 4th, 1884.

There have been complaints recently of delays in the transmission of telegraphic dispatches between this country and Brazil. Salvador de Mendonca, the Brazilian Consul-General in the United States, states that he has been requested by the Director-General of Telegraphs of Brazil to say that the delays complained of have not been due to the Government lines. It is asserted that the service of those lines "is performed with dispatch and regularity."

The Boston Telegraph Company.

The certificate of incorporation of the Boston Telegraph Company was filed in the County Clerk's office at New York. The lines of the company are to be run from Boston through Massachusetts to Hartford and Stamford, Conn., and thence to New York City. The capital stock is $150,000, with the right to increase it to $250,000. The corporators are Chauncey Belknap, Harvey L. Lupkin, and T. Kensett Wheeler.

Curious Incidents in Connection With Telegraphing.

SOME ODD ADVENTURES OF TELEGRAPH OPERATORS.

The delicate instruments of a telegraph office are not indispensable to communicating by telegraph. The Morse alphabet may be read by those familiar with it by hearing, sight, taste and feeling. Its dots and dashes may be expressed by anything that will make a sounder, by a stick waved in the air, or by a light in the dark. There are some curious instances of telegraphing without key, relay and sounder.

About twenty years ago Colonel J. J. S. Wilson, of this city, then an active telegraph superintendent, was on a tour in the southern part of this State. It was a season of floods. Large portions of the country adjacent to the Ohio and Mississippi rivers were inundated, and the wreckage had included the washing away of many miles of poles and wire. It became necessary to communicate with a point on the Missouri bank of the Mississippi river by telegraph. The fertile invention of Colonel Wilson directed that a locomotive be run to the Illinois bank. Mounting the foot-board he grasped the valve and soon the shrill screams of the locomotive whistle were heard by the listening operators on the other shore, whistling out Wilson's message in the long and short sounds of the alphabet familiar to them as that of their primers. Communication was kept up in this way for several hours.

A train on a Western railroad several years ago met with a terrible accident miles from any station. Among the passengers was a young telegrapher. His ready mind took in the situation, and climbing the nearest pole it was an easy task to cut the wire, and using the two ends as a key send a message for help. To receive the reply was a more difficult task. Here again the young man's invention stood in good stead and spurred him on to an exhibition of nerve that is rarely met with. Admonishing the distant operator to send slowly, he placed the cut ends of the wire upon his tongue, and by the strength of each shock to that delicate member made out the letters until the message was complete. That young man's sense of taste was destroyed and returned only in a weakened degree after two or three years.

A rich citizen of San Francisco owes his life to his knowledge of telegraphy acquired many years ago. Wandering over Southern California as a prospector, he was captured by a band of Mexican desperadoes. They carried him to an abandoned hacienda, and with mocking cruelty set him at their table to feast, before, as they told him, they killed him. The prisoner recognized among his captors an old companion, also an operator, who had gone to the bad a little time before. The recognition was mutual, but neither dared to address the other. The captive's quick wit improvised a sounder out of his knife and fork, and, while to the others he appeared playing with them, his cry for assistance was read and understood by his old-time comrade. They formed in this way a plan of escape, which was successfully carried out.

The United States government in several of its lighthouses has the lanterns arranged so as to emit long and short flashes of light, which form certain letters of the telegraphic code. This is a method of distinguishing the beacon, which is easily understood by a little practice. There happened to be an operator on board of a small coasting schooner which was cast on a Florida reef in such a position that escape from the ship and aid from the shore were both out of the question during the night of the wreck. Throughout the long hours of suspense he kept up communication with another operator on shore by means of a lantern, and word of hope, of sympathy, and encouragement passed back and forth until day dawned and made rescue possible.—*Chicago Inter-Ocean.*

The Tropical Telephone Company has sold its plant at Trinidad for about $20,000, some $15,000 payable in cash and the balance before 1886. The Tropical is to get $5 per set per year for the 150 instruments now there until January, 1887, then gets $20 a set bonus, which will end the royalties on these instruments. The new company agrees to buy all of its surplus from the Tropical, and is to receive royalties on all new instruments up to 1892, when the new company is to buy them for $25 a set. The company has a proposition for the purchase of its only remaining exchange, at Barbadoes, a larger one than the Trinidad. It also has an order for another 100 sets from Buenos Ayres. The companies at Rio are moving for a union of interests. A dividend on Tropical is possible next summer.

Military Telegraphy in Belgium.

The telegraphic department is represented in the Belgian army by a company numbering, on a war footing, four officers and 210 men. This company is divided into two divisions. The first is charged with the erection, raising, and destruction of cable and telegraph lines, also with the transmission of optic and acoustic signals. The second, charged with the general service of the permanent lines occupied by the army, has to erect, repair, work, or destroy these lines. The first division is again divided into 3 sections, each provided with the necessary material for erecting 20 kilometers of cable and twenty-four kilometers of wire, besides electric and telegraphic apparatus and apparatus for optic and acoustic telegraphy. The third section is also furnished with the material for repairing workshops, a field forge, and a workshop fitted in a carriage. In each section a wagon is used for carrying 200 telegraph posts and appliances for the work of construction, a cart with twenty-four kilometers of wire wound on bobbins, three wagons with twenty kilometers of cable and four kilometers of special light cable for the outposts. In each wagon are fixed in a separate compartment two sets of apparatus, of which one is a portable station fully equipped for service at the end of the line. The "Compagnie de Telégraphie Militaire" has in all seventeen wagons of six horses each, fifteen of which carry 72 kilometers of naked wire, and 68 kilometers of insulated cable. The wagons are easily drawn by six horses, even when twelve men are seated on each of them. The company constructs three kinds of lines: 1. Lines of copper wire of 0.m002 diameter, fixed on ebony insulators on posts 4m.90 long and 0m.05 diameter. A kilometer of copper wire can be erected in fifty minutes, while twenty minutes are required for raising it. This kind of line is generally used for connecting the permanent system of a country with that which connects the army and the divisions. They are called "lignes d'étapes." The second category of lines is that of isolated cables. They are laid down without posts or isolaters. The cable is secreted in dry ditches, suspended in branches of trees, and through villages, fixed on special supports and on hooks driven into walls. The cable contains a core of copper wire of 0m, 00081 diameter, surrounded by six iron wires of the same diameter, and protected by two layers of vulcanized India-rubber, a spiral band, and a coating of Italian hemp. The diameter of the cable is 0m.00625, it weighs about 72 kilograms per kilometer, and has a straining point of 200 kilograms. A great advantage of the Belgian military system is that during the construction of a line a connecting cable will allow of the telegraph apparatus being connected with the bobbin, so that communication is always kept up with the office at the end of the line without cutting the cable. Twenty minutes are required for constructing or raising a kilometer of cable line. There are, thirdly, flying lines or outpost lines, constructed with a lighter kind of cable. This cable is composed of three copper wires, isolated, and of a conductor formed of eight copper wires, rolled in spiral form, and forming a return line. The whole is coated with hemp, and the total diameter is only 0m.003. This cable, which has a straining power of 30 kilogrammes, is rolled up in parts of 500 meters on a drum, carried by a soldier on his back. The total weight is only 7 kilogrammes. At the outposts the "Buchholtz" telegraphic apparatus is used, which is composed of three small Morse instruments. The soldier carries the Buchholtz apparatus on his chest, and it is connected by a two-metre cable with the knapsack carried by the soldier on his back. With this apparatus it is easy to telegraph even during the march. Each post has two batteries, of which one is in reserve, of twelve Siemens and Halske elements. A kilometer of outpost line is constructed in fifteen minutes. The ordinary war telegraph apparatus comprises on the same stand all the Morse appliances complete—manipulator, receiver, galvanometer and lightning conductor. Schmidt batteries are used, fitted in small portable boxes.

Erie Earnings.

The earnings of the Southwestern Division of the Erie Telephone Company for the month of March show an increase of $1,700.

To obviate "kinks" in submarine telegraph cables, and consequently render these important means of communication less liable to break when subjected to a strain, Messrs. Trott and Hamilton have adopted the expedient of making each alternate layer of sheathing cross each other. Thus, if the inner sheathing of hemp has a right-hand "lay," care is taken that the lay of the next sheathing shall be left-handed.

There are 7,700 meters of telegraph lines in Japan, composed of 20,000 meters of wire. In 1882 2,784,287 messages were transmitted.

A bill has passed the Chilian Congress empowering Messrs. Bolton & Dittborn to construct telegraph lines between Valparaiso and Lota.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The Poles to Stand.

Some time since a little clique of speculators and alleged electricians hit upon a novel, and at the time, it must be confessed, a promising scheme of enriching themselves. It consisted in arousing public indignation against their rivals, and thus turning the stream of patronage and shekels toward their own demesne and coffers.

An innocent and gullible citizen was encouraged to bring suit against an electric lighting company, on the ground that the electric wires running through the streets threatened the life of man and beast and the security of real property.

The highly moral and public-spirited persons who had the scheme in hand appeared in court, through their representatives, and, with eyes turned heavenward and hair that fell in waves over their somewhat liberal expanse of ears, told a mournful tale of the danger that hourly threatened the public from their rival's system of electric lighting.

The charge that the electric wires running through the streets had caused the loss of hundreds of thousands of dollars in the city was refuted by the Fire Marshal himself, who showed by his books that the losses that had primarily been caused by the electric mains in question would amount to an hundred dollars during the years they had been established, and the charge that the currents from these mains had an abnormal affinity for firemen could not be sustained even by those who were alleged to have suffered in consequence.

These were trying days and nights for the plaintiff's attorneys—*O amari dies! O flebi'es noctis!!!* Yet all was vain and profitless. Indeed, it proved worse than this, for it reflected discredit upon those who were instrumental in originating the proceedings.

Last week Judge Ingraham, before whom the case was tried in the Special Term of the Superior Court, handed down his long-expected opinion, giving judgment for the defendants, and consequently establishing the right of the Brush Company to erect their poles and wires in the street.

Legislative Unreasonableness.

The bill introduced by Senator Daly, requiring telephone and electric light wires to be put under ground by June 1st, 1885, in cities of 50,000 inhabitants or over, passed the New York Senate last week.

This indiscriminate manner in dealing with kindred subjects is common with most legislatures, but is a specialty with that which meets at the head waters of the Hudson River.

If it were the interests of the people that the promoters of this bill had in view, they have signally failed to further them; and all their legislative lore, all their boasted discernment, has but served to furnish them with a path by which they might depart from their purpose.

The principal advantage of the telephone is that it is not restricted to the use of the wealthy, but may be placed in the hands of the general public. But if expensive subways must be built for it—and, as said before, it may not be properly worked otherwise—it must necessarily be removed from general usage. This is likely to be the result of the measure which passed the State Senate last week, should it become a law, which, happily, is by no means certain.

Did the legislators who voted for this bill know what a fulfillment of its conditions demanded? We think not. If they were accused to-morrow of introducing and furthering class legislation, we are sure they would indignantly deny the accusation; yet is it not legislating for a class, viz., the rich, when they frame a law that robs the general public of one of the greatest conveniences of modern times—the telephone? For, if the now moderate and popular rates were advanced, the use of the telephone would be practically prohibitory. An official account says:

"Mr. Jacobs offered an amendment providing for a commission of three members—two to be appointed by the Mayor of New York and one by the Mayor of Brooklyn—who shall supervise the construction of subways for the use of these various wires, and shall require payment from the companies for their use. Mr. Daly said that this amendment might be worthy of consideration as an independent measure, to tack it on to this bill he would regard as an attempt to kill the bill. Mr. Campbell also objected to the amendment, and Mr. Jacobs withdrew it. Mr. Thatcher then moved that telephone wires be exempted from the operation of the bill. He argued that there were scientific objections to placing telephonic wires under ground, and it would also be impracticable, owing to the frequent changes in the direction of these wires, to accommodate their constantly-changing patrons. Mr. Daly objected to any amendment whatever, and looked upon all of them as designed to kill the bill. There were no valid objections to the bill, scientific or otherwise. They had all been fully and completely met by opinions of scientific men and by actual experience in other cities. This bill, he said, had twice passed the Senate—last year and the year before—and he trusted it would pass this year. The telegraph poles and wires had come to be an intolerable nuisance in New York City; ninety-nine out of a hundred of the citizens of New York demanded its abatement; nobody defended the measure except persons interested in telegraph, or telephone, or electric light companies. All amendments were voted down, and the bill was passed by twenty-one votes."

There was at least one man in that Senate Chamber who knew a hawk from a handsaw. His name is Thatcher, and, although an American by birth, he had the hardihood to suggest that possibly it would be as well to see what was in the gun before it was fired. This ridiculous suggestion on his part was, of course, at once voted down, as a Senate made up, in great part, of "Milesian-Americans" may, very naturally, be expected to get along without recourse to any mental processes, which would prove especially irksome in this case, as the peculiar species of human being referred to has never been known to possess any mind at all.

In Mr. Daly's opinion, no one is opposed to the crying injustice, of which he is the irresponsible father, but those interested in telegraph, telephone, and electric light companies.

If it's a fair question, we should like to ask him who he expected would be opposed to it—the cheese manufacturers, the organ-grinders, and the dynamite warriors? If a bill was introduced affecting the interests of the bakers, we think the bakers themselves would, naturally enough, be found to be most interested in it. Surely, he would not expect the cobblers to exhibit any ardor or enthusiasm concerning it.

But we can assure him that, if the public were aware that through his stupidity and ignorance they would soon have to either pay double, and perhaps quadruple, for telephone service, they would soon sweep him into that obscurity from which he recently emerged, and where he and all his kind belong.

Subterranean Cables.

The ingenuity of the French has found a fine field for display in subterranean telegraphy.

The publication *L' Electricien*, of Paris, gives an interesting description of the results obtained. It was in the year 1879 that the adoption of this system was finally settled upon, and although all the projected lines have not yet been marked out, many are working satisfactorily. These lines may be placed under two distinct heads—main lines and armès cables.

In the main lines are included at least six conducting wires; these being enclosed in two cables, which are again closed in jointed cast iron tubes. These may at any time be taken up and examined at distances 1,640 ft. apart. The armès cables form the branch lines. They contain one, two, and sometimes three wires, being laid in trenches about four feet deep.

Of course the main lines are the most interesting because they present the most technical difficulties to the electrician by reason of the effects of condensation of mutual induction between the wires and to the earth currents to which they are exposed.

Referring to these, *L' Electricien* says:

"The difficulties arising from condensation are not greater than those met with in submarine telegraphs, while the subterranean line possesses the great advantage of being able to be worked in sections, with relays. It is found that up to 400 kilometers (248½ miles) the line gives the same speed of transmission as an aerial one, and as the interposition of a relay with a light armature causes no retardation, the length of line laid down in sections of this length may be practically unlimited. The currents with which the Hughes instruments work (this being the system employed) are slight; and therefore the dynamic induction is of small importance, while the chief difficulty is caused by the mutual electrostatic induction of the currents in the different wires, which increases as the square of the length of the line. This has been greatly diminished by the ingenious device of placing the wires of long and short lines together. In the case of powerful earth currents, electric storms, etc., the wires can always be joined; and by working thus with a complete metallic circuit entirely isolated from the earth, much greater immunity from disturbance can be obtained than with aerial lines. The "wires" of the main lines consist of seven strands of copper wire covered with three layers of gutta-percha, cemented on with Chatterton composition. The whole is then covered with several folds of tanned jute coarsely woven, secured by an outside bandage of tanned cotton cloth. 11,184 miles of this line are now in daily use, and the quantity is steadily being increased."

The system of laying these wires is being constantly improved upon, and though there are some parts of the line which under certain conditions, do not as yet give the best results, there is reason to believe that in the not distant future every obstacle in the way of a complete success may be removed.

Flaws in the Postal Telegraph Bill.

When strenuous exertions were making to establish a Government telegraph and the appointment of the Grand Army of additional office holders that such a movement would entail, the REVIEW pointed out the evils that would result from any such undertaking on the part of the State. Not even the argument of that able constitutional lawyer, Senator Edmunds, of Vermont, could make Congress believe that the Constitution gave the State a right to enter into direct commercial competition with private parties, and the idea would seem to have been given up.

The Postal-Telegraph bill which was recently drawn up by the Senate Committee on Post Offices and Post Roads has much to commend it. It authorizes the Government not to go into the telegraph business, as did the other, but to contract with private parties for telegraphic service at stated rates.

Curiously enough, however, the very thing that made a postal service and competitive telegraph service imperative, has been overlooked in the drawing up of this bill.

Hence it is that the REVIEW, though favoring the scheme of a postal-telegraph, such as is proposed, is decidedly averse to the onerous conditions which the Government, should this bill become a law, must impose upon itself.

Let us look at some of the conditions of this bill:

"Be it enacted, etc., That the Postmaster-General shall establish telegraph offices at all post offices on telegraph circuits and at all other post offices within 10 miles of any such circuit where the salary of the postmaster is not less than $500 per annum. * * * * That the better to carry out the purposes of this act the office of Fourth Assistant Postmaster General is hereby created; such officer, who shall be a competent and skillful electrician, to exercise a general power of management and control over the telegraphic system hereby established. * * * * The charges for the transmission of telegrams, excepting service and Government telegrams, shall be prepaid by telegram stamps or by postal-telegraph cards, and the maximum rates for telegrams of 20 words or less shall be as follows: When the distance of transmission is 1,000 miles or under, 20 cents; when over 1,000 or under 2,000 miles, 40 cents; for all greater distances, 50 cents; for telegrams directed to be transmitted by night under 2,000 miles, 15 cents; for greater distances, 25 cents; All words shall be counted, and for every five additional words or less, one-fifth additional rate shall be charged. These rates shall cover the cost of immediate and special delivery within a mile of the telegraph office, or within the letter-carrier delivery, and of transmission by mail when received at or destined for any place where there is no postal telegraph office. All telegrams between the several agents and employes, and all such telegrams authorized or required by any officer or employe of the United States, in execution of any duty devolved on him by law, shall, when required by him, have priority in transmission without prepayment, and at rates to be annually fixed by the Postmaster-General. All other telegrams shall be transmitted in the order in which they are received, excepting telegrams directed to be transmitted at night, namely,

between the hours of 7 o'clock in the afternoon and 7 o'clock in the forenoon.

"That upon the prepayment of one-half rate additional, to insure accuracy of transmission and delivery, any message may be repeated back from the place of address to the place of its origin, and a copy thereof delivered to the sender, together with a notice of the time of delivery or of the causes for non-delivery, as the case may be. Prepayment of answer may also be made by the sender of any message by depositing additional stamps to the amount of said one-half rate, as above provided. That the charges for the transmission of special telegrams to newspapers and commercial news associations for each 100 words or less for each circuit of 1,000 miles shall not exceed 50 cents if sent at night, and $1 during the day, but when copies of the same telegram are dropped off at one or more offices the rate for each office shall not exceed 50 cents at night and 75 cents during the day, and at the same pro rata rate for each word in excess. Where special telegrams are delivered at the same office for two or more newspapers, 10 cents additional shall be charged for each 100 words or less for manifolding for each newspaper receiving the same."

When considering these prices, it must be remembered that the Government binds itself to furnish to the contractors all offices free of charge, thus relieving them from the most important factors of expense which appear in the accounts of all telegraphic companies.

Granting that the rates for long distance messages of 20 words are not exorbitant, the short distance rates, under the circumstances, are by no means attractive. It seems to be taken for granted that only rich people wish to telegraph to distances of less than 1,000 miles.

The fact is, in order to make telegraphic service popular, and that, if we understand the question, is one of the principal arguments in favor of a postal-telegraph, there must be an inducement held out to persons of limited means—the general public, for instance—to use the telegraph. Now, at the present time, over the lines of that gigantic monopoly, the Western Union Telegraph Company, messages can be sent to short distances at the general rate of fifteen cents for 10 words, and the signature and address thrown in.

The 20 words clause in the bill is little short of ridiculous. It would force a person having only 8 or 10 words to transmit to pay for double the number.

"The Postmaster-General is hereby authorized and directed to advertise for three months in two of the daily newspapers published in each of the cities of Washington, Baltimore, Philadelphia, New York, Boston, Chicago, and St. Louis for sealed proposals from any telegraph company or companies, now or hereafter incorporated, for the transmission of correspondence by telegraph, according to the provisions of this act, and shall contract with the lowest responsible bidder or bidders to perform in whole or in part the telegraphic service or services by this act provided for, and at or within the maximum rates hereinbefore specified, the company or companies so contracting to enter into bond, with approved security, in such amount as the Postmaster-General shall designate. Said contract or contracts shall be for the term of 10 years, terminable at the option of Congress.

"The Postmaster-General shall furnish at each postal telegraph office such suitable place for the office, employes, instruments, and batteries of such contracting company or companies as shall be necessary for the public business. Such company or companies shall have the right to construct lines on all post routes and shall provide lines of telegraph to every postal office on request of the Postmaster-General. In case it shall fail to perform the service and duties imposed upon it under and according to the provisions of this act, the Postmaster-General may make deductions from the pay of the company for such failure, according to existing laws regulating the Post Office Department. The Postmaster-General shall cause monthly accounts to be prepared for the company or companies performing such telegraph service, of the amount of telegram stamps sold, and of all other sums received for the transmission of telegrams and of the number of telegrams received by the department and their stamped value, and, after deducting 3 cents on each telegram transmitted, shall pay the remainder of such receipts to the said contracting company or companies as full compensation for its services under said contract. The said company or companies contracting for the service herein provided for may, at its or their own expense, establish and maintain telegraph offices for the reception, transmission, and delivery of telegrams in addition to those established by the Postmaster-General as herein provided."

There are those who will object to this plan that contractors can rarely be forced to deal fairly with the Government or to carry out the stipulations of its contract. When the amount agreed upon proves insufficient to insure them a good profit, they have, up to this writing, generally found political friends who could have a bill for their relief inserted in the budget for the fiscal year, while on the other hand they never fail to make the Government carry out the very letter of its side of a contract.

Whoever has watched the working of this system of giving contracts will not fail to corroborate this.

As a fair example of what a Government contractor can do, let us take that of carrying the mails between the post offices and the steam carriers. The daily press has teemed with complaints against Contractor Otis, who carries, or, at least, tries to carry, the New York City mails. The wagons are old and rickety, and the horses, or, at least, most of them, are worth only what they would bring for their hides. The drivers are ununiformed boys or inefficient men, irresponsible and careless. The price Otis pays for drivers is not sufficient to attract efficient men, as the price he pays for horses falls far short of what good animals can be had for. Yet, despite this, and despite his continual failures to carry out the terms of his agreement with the Government, this contractor manages to retain his contract and get from the Government the same amount, minus a few unimportant fines, that he was to receive only in the event of his fulfilling the stipulations of the contract.

"The Postmaster-General is hereby authorized and directed to advertise, as herein provided, for sealed proposals either to sell existing telegraph lines and franchises to the Government or to construct four new telegraphic trunk lines for the Government, so located and arranged as to connect the Northeastern, Northwestern, Western, and Southwestern and Southern parts of the United States with the city of Washington; and if, upon investigation, any such proposals, either to sell existing lines to or construct new lines for the Government are deemed fair and reasonable, the Postmaster-General will report the same to Congress at its next session for acceptance or rejection.

In the event of no existing or hereafter organized telegraph company will contract for the performance of the service by this act provided for and at the rates hereinbefore specified or less, and in the event no satisfactory proposition either to sell existing line or lines, or contract for the construction of new ones for the Government, shall be submitted on or before the 25th day of November, 1884, then there shall be established, built, operated, and carried on a postal telegraph system within the United States in the manner and by the means following: A board consisting of the Secretary of State, the Secretary of War, and the Postmaster-General shall cause to be located and arranged four trunk lines of said postal telegraph, connecting the Northeastern, the Northwestern, the Western and Southwestern and the Southern parts of the United States with the city of Washington * * * Said lines of postal telegraph shall be constructed and kept in repair under the direction and superintendence of the Secretary of War and through the Corps of Engineers * * * The Secretary of War is hereby authorized and directed to acquire by purchase, subject to the approval of the President of the United States, the right of way for the construction of said postal telegraph lines and their extensions from time to time; and said Secretary, with such approval, is authorized and directed to locate such lines and to take and use for that purpose such lands, tenements, and hereditaments as shall be necessary for the purpose, and pay such compensation therefor as shall be deemed reasonable; and in case an agreement cannot be made with persons or corporations, whether municipal or other, in respect to such compensation, such person or corporation is hereby authorized to file a petition for the ascertainment of such just compensation in the Court of Claims of the United States. * * The Secretary of War is hereby authorized and directed, with the approval of the President of the United States, to construct or take and use all such machinery, appliances, devices, and materials, not including telegraph lines owned by persons or corporations, whether patented or not, as shall be deemed necessary for the convenient and successful establishment and operation of said lines."

From this it would appear that the Government, if it escapes the fire-pan of contracts which it alone has to carry out to the letter, is likely to fall into the fire of telegraph building and operating.

We can imagine the glee with which the hungry politicians would hail the passage by Congress of an appropriation for the building and operating of a grand system of telegraphing.

Who can forget the building of the Union and Central Pacific railroads under a Government guarantee of bonds?

The contractors got $75,000 a mile for mountain grades, and $50,000 a mile for the plains, as smooth as a table and as hard as a board. These contractors, of course, were part and parcel of the ring that got the appropriations, and no doubt they had to do much dividing with the fifty and sixty per cent. which they reaped; while on the other hand the Government has not, up to this day, been able to get what it was promised for its aid.

Looking carefully at the two propositions, the one to hire the services of a private corporation, the other to build or buy, we are inclined to think the first-mentioned the best, if for no other reason, because it will furnish room for fewer political appointees. But in the one fixed upon by the Senate Committee, the rates, though not unreasonable for long distances, are absurdly high and exacting for short distances, if it is the intention to make telegraphing popular, as in England.

Supposed to Have Been Caused by the Electric Light.

Fortunately for the public, the electric light has a real value, and hence is able to work out its own salvation, else had it long since succumbed to the malignity of those interested in gas manufacture, directly or indirectly.

That the principal owners of some of the daily journals are holders of gas stocks, is as apparent as that they lose no chance of misinforming the public as to the character of electric light, and as certain as that the public will eventually demand the electric light in spite of their most strenuous protests and their double-leaded columns of drivel.

The last harmless bombshell sent up by the gas people was printed last week under thrilling head lines. Here it is:

"A RIVER STEAMER BURNED.

ELEVEN PERSONS KNOWN TO HAVE PERISHED—FIRED FROM AN ELECTRIC LIGHT—HEROIC CONDUCT OF THE PILOT AND HIS YOUTHFUL SON.

EUFAULA, Ala., April 3.—The steamer Rebecca Everingham, one of the Central Line boats plying between Columbus, Ga., and Apalachicola, Fla., was burned to the water's edge at Fitzgerald's Landing, four miles above Florence, Ga., and twenty-eight miles above Eufaula, at 4:05 o'clock this morning. She was loaded with 350 bales of cotton, and carried about thirty passengers. The fire is supposed to have been caused by a falling particle of carbon from an electric light. The boat was midstream when the alarm was given, and she was quickly enveloped in smoke and flame, lighting up the sky for miles around. The shrieks of the terrified passengers and crew mingled with the roar of the flames were heart-piercing. Men and women rushed hither and thither in their night garments imploring help. The boat was headed for the land by the pilot, but before a landing was effected nearly every part of the vessel was surrounded by fire. Within thirty minutes after the bank was touched, and the few that it was possible to save had landed, the boat was burned down to the hull. The flames severing the moorings, the hull drifted into the stream and sank half a mile below.

As will be seen, the account reads: "The fire is *supposed* to have been caused by a falling particle of carbon from an electric light."

Now, we will ask any fair-minded man not engaged in manufacturing, distributing, or vending poisonous illuminating gases, if the sentence quoted—which is all that is said about the electric light in the whole dispatch—furnishes a sufficient warrant for the subhead: "Fired From an Electric Light?" If the president of a gas lighting company, for example, were found dead on a public highway, near which a mule was seen to be peacefully feeding, might the coroner fairly claim that he was kicked to death by the mule? We think not.

We happen to know something about the line of boats to which the unfortunate steamer *Everingham* belonged, having frequently patronized it, and we think we can show that there are many dangers from fire which threaten these boats greater than any which might befall them by reason of the presence of an electric light. Indeed, we want better authority than any we have seen yet to prove to us that there was an electric light aboard. These boats run down the Chattahoochee, Flint, and Apalachicola rivers to Apalachicola, Fla., in the Gulf of Mexico—or, rather, on the Bay of Apalachicola, which empties into the Gulf. They are rickety old structures, called "river wheelbarrows" for the reason that they have only one paddle-wheel, and that is carried behind. The architecture of one of these boats is a compromise between the mud scow and the grain elevator, being flat-bottomed, top-heavy, with a construction of pine boards and tenpenny nails, and having a stern that flares upward and outward like a Dutch galleon down by the head.

The crew of twenty negroes are usually divided into two watches, one being employed in heaving fat pine-knots under the boilers of the high pressure engine, while the other is distributed among the bales of cotton and other inflammable material, smoking pipes.

Yet the enterprising correspondent of the Associated Press, being called upon to *guess* what set this river boat afire, guesses it was a spark from the electric light.

It being our turn to guess, we'll guess it was one of the "niggers" smoking a pipe on a bale of cotton, and we'll leave it to any man not, as we said before, interested in gas stocks, and knowing something about the relative danger to cotton from sparks from a voltaic arc light and colored "puss'ns" smoking pipes, if our theory of the cause of that fire is not more logical than that advanced in the afore-quoted dispatch.

Talk away, gentlemen, against the electric light; the day is not far distant when you will be compelled to eat your words, for the electric light will soon be universally adopted. It is spreading far and near, and whoever once uses it will be loth to do without it, and those who have it not will cry for it, as the children of Israel cried for bread in the wilderness long ago.

After the little men, who now howl in derision at the electric light, are gone and long since forgotten, the electric light will be at work rivaling the glimpses of the moon, and man—vain man—will be recalling as a curious evidence of the prevailing ignorance of the preceding generation, the stupid and senseless diatribes that were once written on the subject of the impracticability of any system of electrical lighting.

The gas or caloric engine in the opinion of Dr. Siemens combines the conditions most favorable to the attainment of maximum results, and it may reasonably be supposed that the difficulties still in the way of their application on a large scale will gradually be reversed.

Before many years have elapsed we shall no doubt find in our factories and aboard our ships engines with a fuel consumption not exceeding 1 pound of coal per effective horse-power per hour, in which the gas producer will take the place of the somewhat complex and dangerous steam boiler.

The advent of such an engine and of the dynamo-machine must mark a new era of material progress at least equal to that produced by the introduction of steam-power in the early part of the present century.

This is how gas may be practically employed, and to such uses there is still reason to believe it will in the future be restricted.

For places where a gas-engine may be useful, and where a supply of street gas is not available, a new combination of gas-producer and gas engine has been devised.

The aim has been to make a producer that should be cheap, simple, and easily managed, and yet capable of making a gas of sufficient richness to be of use in a gas-engine.

It consists of a small vessel lined with some refractory material, and having an opening at the top for inserting the coal.

This top is closed by a cover having a rim or flange that fits into a joint filled with sand.

At the bottom the vessel is provided with a fire-pot formed of inclined grate-bars.

These bars rest at the top upon a circular pipe, perforated with fine holes and designed to spread a film of water over the bars, to keep the apparatus cool and create a certain amount of steam.

In the upper part of the producer is an annular hood, or cap, hanging down into the vessel.

This serves to keep the fuel in the center of the vessel, and leaves an annular space at the top, through which the products of combustion may escape.

A gas pipe joined to the top of the producer leads the gas to the scrubber, which is simply a vessel partly filled with water, through which the water bubbles upwards on its way to the engine.

This is all that is required for producing a sufficiently good gas for the purpose.

On starting the apparatus, the producer is filled with coal and the fire lighted.

At first the products of combustion are allowed to escape through a chimney over the scrubber.

Then the chimney is closed, and the water is allowed to flow over the grate bars.

It is turned into vapor, and, together with a small quantity of air, enters the producer, the proper direction being given to the products of combustion by the exhaust caused by the engine in consuming the gas.

The engine consists of two upright cylinders placed side by side, and having a set of valves common to them both, in a circular chamber, between them.

There is also a reservoir for storing the gas, and a system of regenerators, formed of wire-netting, for heating the gas before it is burned.

On the top of the engine is a small vessel intended to hold a quantity of some light hydro-carbon for enriching the gas just before it is burned.

The operation of the engine appears to be somewhat complicated.

The upward movement of each piston draws a mixture of gas and air into the cylinder, and its return stroke compresses the explosive mixture and delivers it into the reservoir.

The effective downward stroke is caused by admitting a portion of gas from the reservoir above the fixtures.

At the same time, a small portion of the hydro-carbon is added to it, and the mixture is fired by electricity.

After the explosion, the waste gases pass through the regenerators into the exhaust-pipe and thus escape.

The regenerators absorb a part of the heat of the exhaust, and they, in their turn, give it up again to the next supply of gas that is admitted.

The engine, while it is complicated, has the merit of compactness and convenience of position, as it stands upright, and, having two cylinders, one is always doing effective work.

We are very glad to learn from our correspondent in Boston that the handsome and genial general agent of the Brush-Swan Company for New England, Mr. Frank Ridlon, has recently had the much-sought for degree of P(h).D. conferred upon him.

There was a new operator in the office. The repairer called up from a sick telephone and asked: "How do you get me?" "Hey?" "How do you get me?" "How do I get you?" "Yes! how do you get me?" "I get you by calling, of course; how did you reckon I got you?"

The Arminglon & Sims Engine Company have placed in the British House of Commons a second engine, for the purpose of driving additional electric light machinery. As one of these engines has been in use in the House for some two years, the company feel especially pleased to receive another order. It also speaks well for the engine that, in spite of a strenuous competition from British manufacturers, there are already some 30 of these engines running in the city of London.

Average Telephone Stock Quotations, for week ending April 10th, 1884.

	Highest.	Lowest.
American Bell Telephone Co.	174	168
Central New York Telephone and Telegraph Company	164	160
Empire State Telephone and Telegraph Company	195	187
Hudson River Telephone and Telegraph Company	100	92
New York and New Jersey Telephone Company	86	74
Mexican Telephone Company	2½	2¼
New York and Pennsylvania Telephone Company	76	67
Southern Bell Telephone and Telegraph Company	125	120
Tropical Telephone Company	3	2½
Central Union Telephone Co.	100	90
Iowa Union " "	100	90
Missouri and Kansas Telephone Co.	98	80
United Telephone Co. (Kansas and Missouri)	99	80
Bell Telephone Company, of Missouri	160	150
Wisconsin Telephone Company	120	115
Cumberland Telephone Co	100	95
Great Southern Telephone Co.	100	92
Michigan Telephone Company	100	97
Chicago Telephone Company	290	280
Erie Telephone Company	41	36
Union Telephone Company	100	95
Southern New England Telephone Company	165	160
New England Telephone Co.	53	46
Chesapeake & Potomac Tel. Co.	100	95

Average Market Quotations of Battery Supplies for the Week Ending April 10th, 1884.

Leclanche Disque Cell, complete	$1.25
" Prism " "	$1.67
" Prisms, per pair	$1.00
" Carbon Mounted	30c.
" Jar Cover	12c
" Sal Ammoniac, in bag	8c.
" Porous Cell	$1.10
" Glass Jar	18c.
" Amalgamated Zinc	10c.
" Rubber Bands, per pair	6c.
Chlorine Battery, per cell	$1.25
Law Battery, per cell	$1.25
" Jar and its Rubber Ring	25c.
" Cover, with small Carbon sealed in	35c.
" Large Carbons, each	20c.
" Carbon Connector	12c.
" Zinc Connector	8c.
" Rubber Bolt	12c.
" Zinc and its Rubber Ring	12c.
Bergman & Haid, per cell	$1.20
Crow foot, 6x8, per cell	75c.
Callaud Zincs	30c.
" Coppers	15c.
" Jars	25c.
Sal Ammoniac, per lb.	15c.
Blue vitriol, per lb.	10c.
" " bbl., lots, per lb.	5½c
Sulphate of zinc	10c.
Battery syringe	$1.90c.
Battery brush	20c.
Hydrometer	50c.

Send to our advertisers for price lists.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 1, 1884.

295,905 Telegraph or other poles; Geo F. Brott, Washington, D.C.

295,913 Telephone signaling apparatus; Walter J. Dudley, Everett, Mass., assignor to the Dudley Electric Manufacturing Company, Concord, N.H.

295,966 Manufacture of compound electric wire; John J. Williamson, Boston, Mass.

295,983 Telephone; Frank B. Cooke and Frank F. Graves, Toledo, O.

296,074 Manufacture of electrical conductors; Thomas Shaw, Newark, N. J., assignor to William H. Ritter, New York, N. Y.

296,125 Automatic cut-out for electric lamps; Charles L. Buckingham and Henry C. Townsend, New York, N. Y.

296,146 Insulator for electric conductors; William Hope Davis, Springfield, Ill.

296,148 Apparatus for collecting and removing waste from spinning machines: William Albert Delmage, Lowell, Mass.

296,160 Binding post for electric conductors; Albert George Goodbody, Louisville, Ky.

296,185 Electrical conductor and connecting device therefor: John Kreusi, Brooklyn, assignor to the Electric Tube Company, New York, N. Y.

296,211 Electro-magnetic car-brake; Harvey S. Park, Henderson, Ky.

296,212 Electro-magnetic car-brake; Harvey S. Park, Henderson, Ky.

296,253 Electric switchboard; Theodore N. Vail, Boston, Mass.

296,256 Clock synchronizing apparatus; Gustavus G. Wagner, Mount Vernon, N. Y.

296,294 Insulated conductor; Theodore Miner, Brooklyn, N. Y.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

ELECTRICAL AND MECHANICAL ENGINEER, very experienced in designing dynamos and lamps, &c., &c., wants position as electrician, with already established or now forming company. Address "Electrician," P. O. box 88, Greenpoint. L. I.

Notice.

The new (1884) edition, "Berly's Universal Electrical Directory," now ready for delivery, price $3, has been thoroughly revised, greatly enlarged, and many new features added to enhance its value. Send for descriptive circular and table of contents. Cumming & Brinkerhoff, 219 East Eighteenth Street, New York City.

WANTED.—Wanted immediately, by the Kansas Electric Light Company, a man thoroughly competent to take charge of the electrical machinery of a 200-light plant where the Thomson-Houston system is in use. Good references as to practical ability and character required. Address E. R. Weeks, Supt., Kansas City, Mo.

WANTED.—An experienced telephone man that can take position of managing an exchange, and will work himself in construction. Address Foreign, care of ELECTRICAL REVIEW.

The Ansonia Brass & Copper Company of New York, is now manufacturing what it calls "acme bronze" wire, especially for telegraph and telephone purposes, which is highly spoken of. Lake Superior copper is used in its construction.

Neatly-bound volumes (half-yearly) of the ELECTRICAL REVIEW will be sent, postage prepaid, on receipt of $3; also the latest improved self-binders for the ELECTRICAL REVIEW, or any other electrical or scientific journal published in this country, for $1. Delano & Company, publishers, 23 Park Row, New York, N. Y.

WANTED.—First-class men on burglar alarm, hotel and house annunciator work; also first-class electrical instrument makers in western city. Permanent positions to right men. Address, with reference, giving experience, D., care Electrical Review, 23 Park Row, N. Y.

BUSINESS NOTICES.

A. C. NORTHROP, Waterbury, Conn. Iron and Brass Machine Screws, Zinc in Sheets and Plate for Electrical Purposes, Parts for Telephone and Telegraph Instruments, Manufactured from Iron, Brass, Steel or Zinc.

A. G. DAY, Kerite Insulated Telegraph and Telephone Wire and Cables, Anti-induction Kerite Telephone Cables, CLARKE B. HOTCHKISS, New York. Send for circular and prices.

ALFRED F. MOORE, Philadelphia, Pa. Telegraph, Telephone, Electric Light, Office, Line and Annunciator Wire.

AMERICAN BELL TELEPHONE Co., Boston, Mass. Electric Speaking Telephones for Exchange Systems, Private Lines, and Speaking-tube Lines.

AMERICAN ELECTRICAL WORKS, Providence, R. I. Patent Finished Insulated Electric Wires, Telephone and Electric Cordage. Electric Light Wire, Magnet Wire, Patent Rubber covered Wire. Aerial and Underground Cables, &c., &c. Send for prices.

AMERICAN SPIRAL TELEPHONE WIRE Co., Boston, Mass. Spiral Telephone Wire for long and short distance Telephoning. Write for information.

ARMINGTON & SIMS, Providence, R. I. Engines for Electric Lighting and general use.

AUSTIN GALLAGHER, New York. Keith Electric Light System complete for Arc Lighting. Stock for sale.

BAXTER ELECTRIC LIGHT COMPANY, New York. The Baxter Lamp.

B. W. PAYNE & SONS, Corning, N. Y. The Payne Single and Double Valve Automatic Engine. Send for catalogue.

BERGMAN & Co., New York. The Bergman and Haid Battery for Telephone and Telegraph purposes. Send for circular.

BOULTON CARBON Co., Cleveland, Ohio. Carbons for Electric Light purposes. Send for quotations.

BROWNLEE & Co., Detroit, Mich. Telegraph and Telephone Poles.

BRUSH ELECTRIC Co., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER SAFES, New York. Fire and Burglar-Proof.

CHARLES WILLIAMS, JR., Boston, Mass. Call Bells, Electric Bells, District Bells, Switch Boards, Annunciators, &c., &c. Write for quotations.

CHICAGO INSULATING Co., Chicago, Ill. The Fiske-Mott High-resistance Insulator. Send for circular.

CHROME STEEL WORKS, Brooklyn, N. Y. Steel for Magnets a specialty; Chrome Cast Steel.

COE BRASS Co., Torrington, Conn. Brass, Copper and German Silver in every variety of Sheets, Rolls, Plates, Wire, Rods and Blanks or Shells. Pure Lake Superior Copper Wire and Battery Zincs. Write for price list.

CONNOLLY BROTHERS, New York, Patent Attorneys and Solicitors.

HARVEY, STAFFORD & Co., Acton, Ont., Canada Telegraph and Telephone Poles.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

ELECTRIC STORAGE AND LIGHT Co., Boston, Mass. Own patents for Faure's Storage Batteries for territory of Rhode Island, Connecticut and Massachusetts.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fire-proof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & Co., Fitchburg, Mass. Dynamo Electric Machines.

IVISON, BLAKEMAN & TAYLOR, New York. Ink of all kinds and colors. Circulars sent on application.

JARVIS ENGINEERING COMPANY, Boston, Mass. Boilers set with the Jarvis Patent Furnace.

JOHN H. MUEGGE, New York. Platinum, Chemical Apparatus, Crucibles, etc.

LECLANCHE BATTERY COMPANY, New York. The Great Telephone Battery. Write for description and prices.

J. H. BUNNELL & Co., New York. The Morse Learner's Instrument, Telegraph Instruments of all kinds, Telephone and Telegraph Supplies. Illustrated Works on Electrical Measurement, and the Galvanometer and its uses. Send for catalogue.

LAW TELEGRAPH Co., New York. The Law Battery for Telephone and Telegraph purposes.

LOCKWOOD & FOSTER, New York. Learners' Telegraph Instrument.

MUTUAL DISTRICT MESSENGER Co., Boston, Mass. Addressing and Distributing Circulars &c., &c. D. J. Hern, General Manager.

NATIONAL ELECTRIC COMPANY. Washington, D. C. Electrical supplies and apparatus.

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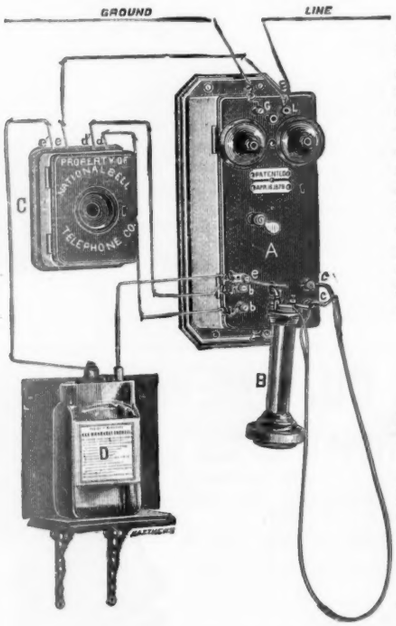

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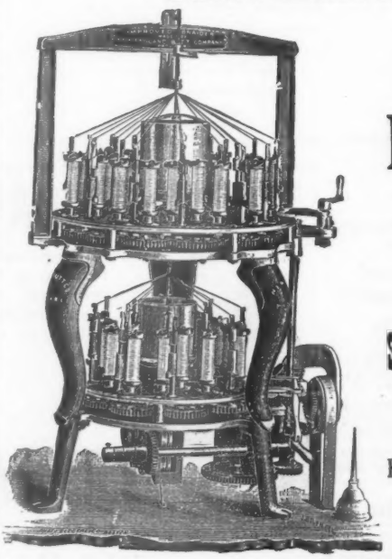

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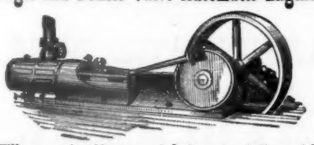

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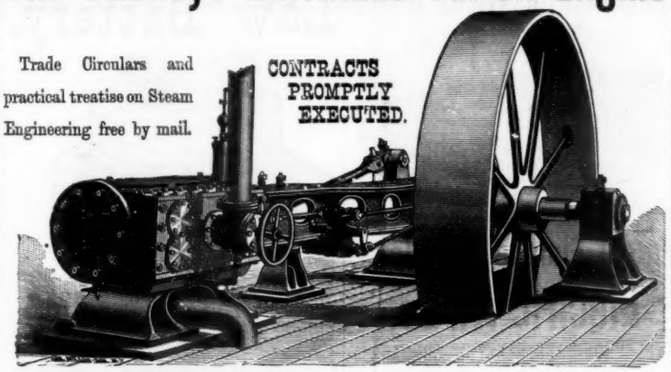

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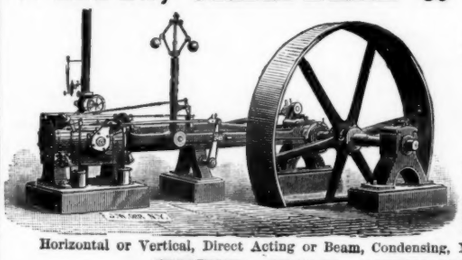

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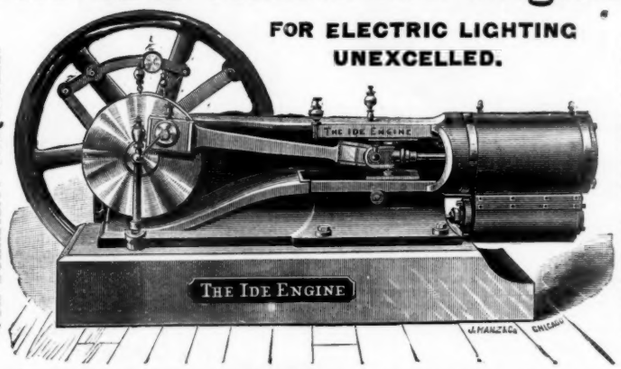

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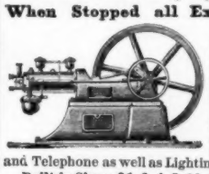

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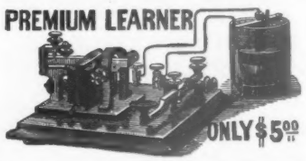

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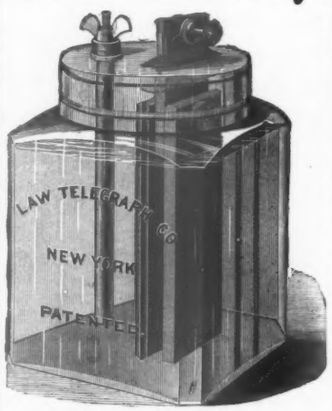

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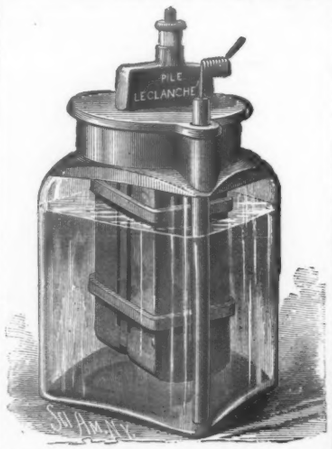

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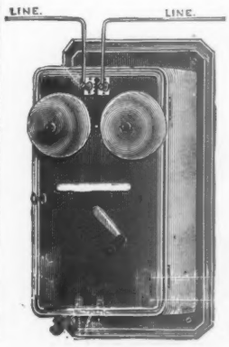

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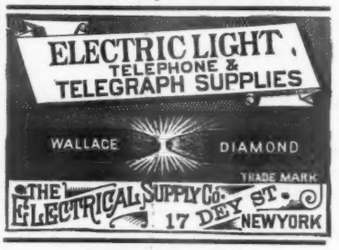

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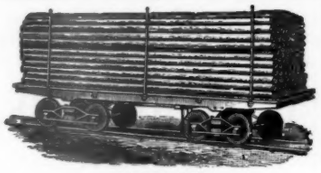

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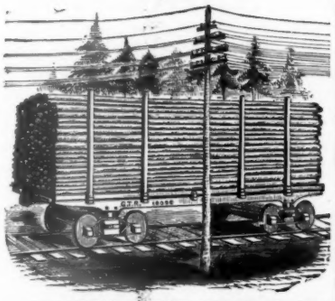

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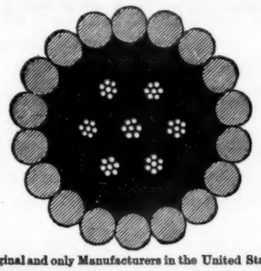

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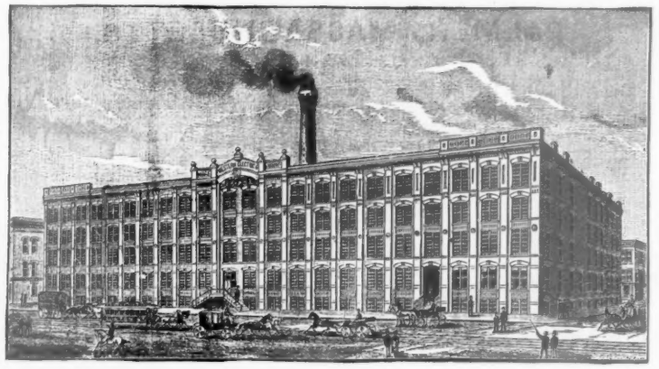

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